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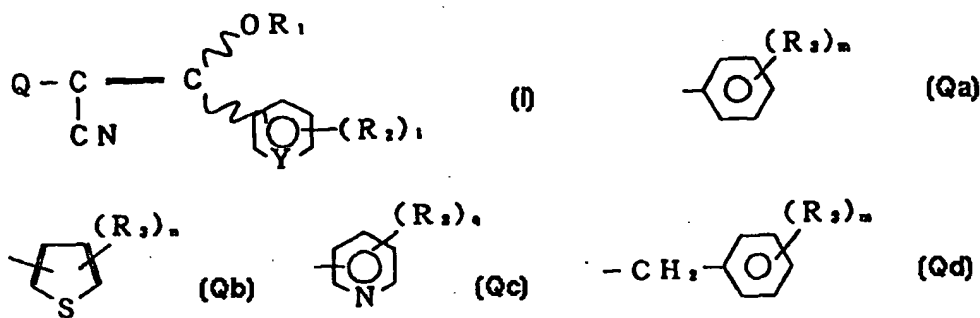
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(57) Abstract

Novel compounds useful as active ingredients of pesticides are disclosed. Acrylonitrile compounds of formula (I) or their salts, wherein Q is Qa, Qb, Qc or Qd, Y is =C(R₄)- or =N-, R₁ is alkyl, haloalkyl, etc., each of R₂ and R₃ is halogen, alkyl which may be substituted, alkenyl which may be substituted, etc., R₄ is hydrogen, halogen, alkyl or haloalkyl, l is from 1 to 4, m is from 0 to 5, n is from 0 to 3, q is from 0 to 4, when l is 2 or more, a plurality of R₂ may be the same or different, when each of m, n and q is 2 or more, a plurality of R₃ may be the same or different.

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DESCRIPTIONACRYLONITRILE COMPOUNDS, PROCESS FOR THEIR PRODUCTION AND
PESTICIDES CONTAINING THEM

5 The present invention relates to novel acrylonitrile compounds useful as active ingredients for pesticides.

(1) EP 104690A, EP 62238A and U.S. Patent 4,469,688, respectively, disclose compounds similar to the compounds of the present invention, but such compounds and the
10 compounds of the present invention are different in their chemical structures.

(2) EP 776879A discloses a process for producing an enol ether which literally covers a part of the compounds of the present invention, but in this publication, there
15 is no specific disclosure at all with respect to the group of compounds of the present invention.

(3) JP-A-60-11401 and JP-A-60-11452, respectively, disclose α -cyanoketone derivatives which literally cover a part of the compounds of the present invention, but in
20 these publications, there is no specific disclosure at all with respect to the group of compounds of the present invention.

(4) U.S. Patent 3,337,565 discloses acrylonitrile derivatives which literally cover a part of the compounds of the present invention, but in this publication, there is no specific disclosure at all with respect to the group of compounds of the present invention.

(5) U.S. Patent 3,337,566 discloses acrylonitrile derivatives similar to the compounds of the present invention, but such derivatives and the compounds of the present invention are different in their chemical structures.

(6) WO97/40009 discloses ethylene derivatives similar to the compounds of the present invention, but the derivatives and the compounds of the present invention are different in their chemical structures.

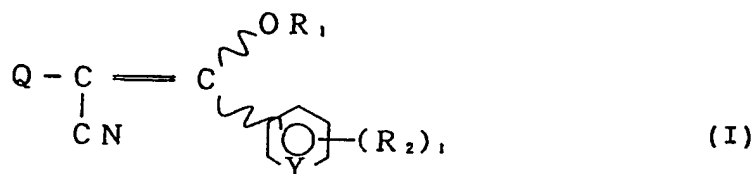
(7) Bulletin de la Societe Chimique de France, 1980, No. 3-4, p. 163-166, discloses 3-(4-chlorophenyl)-2-phenyl-3-ethoxyacrylonitrile, but this compound and the compounds of the present invention are different in their chemical structures.

(8) Journal of Chemical Research (Synopses), 1987, p. 78-79, discloses 2-(3,5-dimethoxyphenyl)-3-(2-methoxy-4-methylphenyl)-3-acetoxyacrylonitrile and 2-(3,5-dimethoxyphenyl)-3-(2,6-dimethoxy-4-methylphenyl)-3-acetoxyacrylonitrile, but these compounds and the compounds of the present invention are different in their chemical structures.

The present inventors have conducted various studies

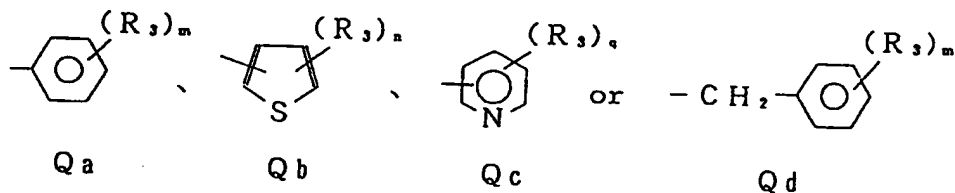
to find out an excellent pesticide, paying an attention to acrylonitrile compounds and, as a result, have accomplished the present invention.

Namely, the present invention provides an
5 acrylonitrile compound of the following formula (I) or
its salt:



10

wherein Q is



Y is $=C(R_4)-$ or $=N-$, R_1 is alkyl, haloalkyl, alkoxyalkyl, alkylthioalkyl, alkenyl, haloalkenyl, alkynyl, haloalkynyl, $-C(=O)R_5$, $-C(=S)R_5$, $-S(O)_wR_5$ or $-CH_2R_9$, each of R_2 and R_3 is halogen, alkyl which may be substituted, alkenyl which may be substituted, alkynyl which may be substituted, alkoxy which may be substituted, alkenyloxy which may be substituted, alkynyloxy which may be substituted, alkylthio which may be substituted, alkylsulfinyl which may be substituted, alkylsulfonyl which may be substituted, alkenylthio which may be substituted, alkenylsulfinyl which may be substituted, alkenylsulfonyl which may be substituted, alkynylthio

which may be substituted, alkynylsulfinyl which may be substituted, alkynylsulfonyl which may be substituted, nitro, cyano, phenyl which may be substituted, phenoxy which may be substituted, phenylthio which may be substituted, phenylsulfinyl which may be substituted, phenylsulfonyl which may be substituted, benzyl which may be substituted, benzyloxy which may be substituted, benzylthio which may be substituted, or benzoyl which may be substituted, R_4 is hydrogen, halogen, alkyl or haloalkyl, R_5 is alkyl which may be substituted, alkenyl which may be substituted, alkynyl which may be substituted, alkoxy which may be substituted, alkenyloxy which may be substituted, alkynyloxy which may be substituted, alkylthio which may be substituted, alkenylthio which may be substituted, alkynylthio which may be substituted, cycloalkyl, cycloalkyloxy, cycloalkylthio, $-N(R_7)R_8$, phenyl which may be substituted, phenoxy which may be substituted, phenylthio which may be substituted, benzyl which may be substituted, benzyloxy which may be substituted, benzylthio which may be substituted, $-J$, $-O-J$ or $-S-J$, each of R_7 and R_8 is hydrogen, alkyl or alkoxy, R_9 is cyano, phenyl which may be substituted, phenoxy which may be substituted, phenylthio which may be substituted, phenylsulfinyl which may be substituted, phenylsulfonyl which may be substituted, benzyl which may be substituted, benzyloxy which may be substituted,

benzylthio which may be substituted, benzoyl which may be substituted, $-J$, $-C(=O)R_{10}$, $-C(=S)R_{10}$, $-S(O)_wR_{10}$ or trimethylsilyl, R_{10} is alkyl or alkoxy, J is a 5- or 6-membered heterocyclic group containing from 1 to 4 hetero atoms of at least one type selected from the group consisting of O, S and N (the heterocyclic group may be substituted), l is from 1 to 4, m is from 0 to 5, n is from 0 to 3, q is from 0 to 4, w is from 0 to 2, when l is 2 or more, a plurality of R_2 may be the same or different, when each of m , n and q is 2 or more, a plurality of R_3 may be the same or different, provided that the following compounds are excluded (1) a compound wherein Q is Qb , Y is $=C(R_4)-$, and R_1 is alkyl, haloalkyl, alkoxyalkyl, alkylthioalkyl, alkenyl, haloalkenyl, alkynyl, haloalkynyl, $-S(O)_wR_5$ or $-CH_2R_9$, (2) a compound wherein Q is Qb , Y is $=C(R_4)-$, R_1 is $-C(=O)R_5$, and R_5 is alkyl which may be substituted, alkenyl which may be substituted, alkynyl which may be substituted, alkoxy which may be substituted, alkenyloxy which may be substituted, alkynyloxy which may be substituted, cycloalkyl, cycloalkyloxy, $-N(R_7)R_8$, phenyl which may be substituted, phenoxy which may be substituted, phenylthio which may be substituted, benzyl which may be substituted, benzyloxy which may be substituted, benzylthio which may be substituted, $-J$, $-O-J$ or $-S-J$, (3) a compound wherein Q is Qb , Y is $=C(R_4)-$, R_1 is $-C(=S)R_5$, and R_5 is $-N(R_7)R_8$, (4) a

compound wherein Q is Qb or Qc, Y is =N-, R₁ is alkyl or -C(=O)R₅, and R₅ is alkyl, (5) 3-(4-chlorophenyl)-2-phenyl-3-ethoxyacrylonitrile, (6) 2-(3,5-dimethoxyphenyl)-3-(2-methoxy-4-methylphenyl)-3-acetoxyacrylonitrile, and (7) 2-(3,5-dimethoxyphenyl)-3-(2,6-dimethoxy-4-methylphenyl)-3-acetoxyacrylonitrile; and a process for its production, a pesticide containing it, and a novel intermediate compound useful for its production.

10 In the formula (I), the substituent for the alkyl which may be substituted, the alkenyl which may be substituted, the alkynyl which may be substituted, the alkoxy which may be substituted, the alkenyloxy which may be substituted, the alkynyloxy which may be substituted, 15 the alkylthio which may be substituted, the alkylsulfinyl which may be substituted, the alkylsulfonyl which may be substituted, the alkenylthio which may be substituted, the alkenylsulfinyl which may be substituted, the alkenylsulfonyl which may be substituted, the alkynylthio 20 which may be substituted, the alkynylsulfinyl which may be substituted and the alkynylsulfonyl which may be substituted, for each of R₂ and R₃, or the substituent for the alkyl which may be substituted, the alkenyl which may be substituted, the alkynyl which may be substituted, 25 the alkoxy which may be substituted, the alkenyloxy which may be substituted, the alkynyloxy which may be substituted, the alkylthio which may be substituted, the

alkenylthio which may be substituted and the alkynylthio which may be substituted, for R_5 , may, for example, be halogen, alkoxy, haloalkoxy, alkoxy carbonyl, alkylthio, alkylsulfinyl, alkylsulfonyl, haloalkylthio,

5 haloalkylsulfinyl, haloalkylsulfonyl, amino, monoalkylamino, dialkylamino, nitro or cyano. The number of substituents may be one or more, and when it is more than one, a plurality of substituents may be the same or different.

10 Further, the substituent for the phenyl which may be substituted, the phenoxy which may be substituted, the phenylthio which may be substituted, the phenylsulfinyl which may be substituted, the phenylsulfonyl which may be substituted, the benzyl which may be substituted, the
15 benzyloxy which may be substituted, the benzylthio which may be substituted or the benzoyl which may be substituted, for each of R_2 and R_3 , the substituent for the phenyl which may be substituted, the phenoxy which may be substituted, the phenylthio which may be
20 substituted, the benzyl which may be substituted, the benzyloxy which may be substituted or the benzylthio which may be substituted, for R_5 , the substituent for the phenyl which may be substituted, the phenoxy which may be substituted, the phenylthio which may be substituted, the
25 phenylsulfinyl which may be substituted, the phenylsulfonyl which may be substituted, the benzyl which may be substituted, the benzyloxy which may be

substituted, the benzylthio which may be substituted or the benzoyl which may be substituted, for R_9 , or the substituent for the heterocyclic ring for J, may, for example, be halogen, alkyl, haloalkyl, alkoxy,

5 haloalkoxy, nitro, cyano, $-S(O)_w R_6$, amino, monoalkylamino or dialkylamino. The number of substituents may be one or more, and when it is more than one, a plurality of substituents may be the same or different. Here, R_6 is alkyl or haloalkyl, and w is from 0 to 2.

10 The heterocyclic group for J may, for example, be furyl, thienyl, pyrrolyl, pyrazolyl, imdazolyl, triazolyl, tetrazolyl, oxazolyl, isoxazolyl, thiazolyl, isothiazolyl, pyridyl, pyrimidinyl, 1-pyrrolidinyl, 1-piperidinyl or 4-morpholino.

15 Preferred compounds among the acrylonitrile compounds of the formula (I) or their salts, are as follows.

(a) The acrylonitrile compound or its salt, wherein Q is Q_a , Q_b or Q_c , and each of R_2 and R_3 is halogen, alkyl, haloalkyl, alkoxy, haloalkoxy, alkylthio, alkylsulfinyl, alkylsulfonyl, nitro, cyano, phenyl which may be
20 substituted by M_1 , or phenoxy which may be substituted by M_1 , R_5 is alkyl, haloalkyl, alkoxyalkyl, alkylthioalkyl, aminoalkyl, monoalkylaminoalkyl, dialkylaminoalkyl, alkenyl, haloalkenyl, alkynyl, haloalkynyl, alkoxy,
25 haloalkoxy, alkylthio, haloalkylthio, alkoxycarbonylalkylthio, alkenylthio, haloalkenylthio, alkynylthio, haloalkynylthio, cycloalkyl, cycloalkylthio,

-N(R₇)R₈, phenyl which may be substituted by M₁, phenoxy which may be substituted by M₁, phenylthio which may be substituted by M₁, benzyl which may be substituted by M₁, benzylthio which may be substituted by M₁, pyridyl which
5 may be substituted by M₁, 1-pyrrolidinyl, 1-piperidinyl, 4-morpholino, pyridyloxy which may be substituted by M₁, or pyridylthio which may be substituted by M₁, R₉ is cyano, phenyl which may be substituted by M₁, benzyloxy which may be substituted by M₁, benzoyl which may be
10 substituted by M₁, pyridyl which may be substituted by M₁, -C(=O)R₁₀, -S(O)_wR₁₀ or trimethylsilyl, M₁ is halogen, alkyl, haloalkyl, alkoxy, haloalkoxy, nitro, cyano, -S(O)_vR₆, amino, monoalkylamino or dialkylamino, and R₆ is alkyl or haloalkyl. The number of substituents M₁ may
15 be one or more, and if it is more than one, a plurality of M₁ may be the same or different.

(b) The acrylonitrile compound or its salt, wherein Q is Qa, Qb or Qc, each of R₂ and R₃ is halogen, alkyl, haloalkyl, alkoxy, haloalkoxy, alkylthio, alkylsulfinyl,
20 alkylsulfonyl, nitro, cyano, phenyl which may be substituted by M₂, or phenoxy which may be substituted by M₂, R₅ is alkyl, haloalkyl, alkoxyalkyl, alkenyl, haloalkenyl, alkynyl, haloalkynyl, alkoxy, haloalkoxy, alkylthio, haloalkylthio, alkoxycarbonylalkylthio,
25 alkenylthio, haloalkenylthio, alkynylthio, haloalkynylthio, cycloalkyl, cycloalkylthio, -N(R₇)R₈, phenyl which may be substituted by M₂, phenoxy which may

be substituted by M_2 , phenylthio which may be substituted by M_2 , benzyl which may be substituted by M_2 , benzylthio which may be substituted by M_2 , pyridyl which may be substituted by M_2 , 1-pyrrolidinyl, 1-piperidinyl or 4-morpholino, each of R_7 and R_8 is hydrogen or alkyl, R_9 is cyano, phenyl which may be substituted by M_2 , benzyloxy which may be substituted by M_2 , benzoyl which may be substituted by M_2 , pyridyl which may be substituted by M_2 , $-C(=O)R_{10}$, $-S(O)_wR_{10}$ or trimethylsilyl, M_2 is halogen, alkyl, haloalkyl, alkoxy, haloalkoxy, nitro, cyano or $-S(O)_wR_6$, and R_6 is alkyl. The number of substituents M_2 may be one or more, and when it is more than one, a plurality of M_2 may be the same or different.

(c) The acrylonitrile compound or its salt according to the above (b), wherein Q is Qa or Qb.

(d) The acrylonitrile compound or its salt according to the above (c), wherein Q is Qa.

(e) The acrylonitrile compound of the above formula (I) or its salt, wherein Q is Qa or Qb, Y is $=C(R_4)-$, and R_4 is hydrogen.

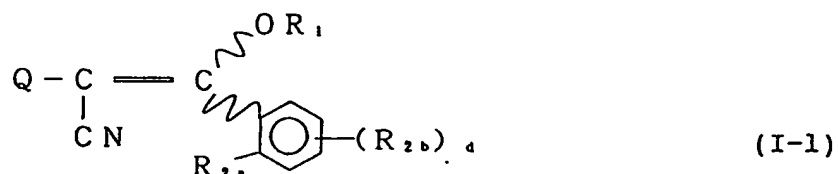
(f) The acrylonitrile compound or its salt according to the above (e), wherein Q is Qa.

(g) The acrylonitrile compound or its salt according to the above (e) or (f), wherein R_2 is halogen, alkyl or haloalkyl, and l is from 1 to 3.

(h) The acrylonitrile compound or its salt according to the above (e) or (f), wherein R_1 is alkoxyalkyl,

-C(=O)R₅, -C(=S)R₅, -S(O)_wR₅ or -CH₂R₉, R₂ is halogen, alkyl or haloalkyl, R₃ is halogen or alkyl, R₅ is alkyl, haloalkyl, alkoxyalkyl, alkoxy, haloalkoxy, alkylthio, haloalkylthio, alkoxyalkylthio, alkenylthio, 5 -N(R₇)R₈, phenyl which may be substituted by M₃, phenoxy which may be substituted by M₃, phenylthio which may be substituted by M₃, benzyl which may be substituted by M₃, pyridyl which may be substituted by M₃, 1-pyrrolidinyl or 4-morpholino, each of R₇ and R₈ is hydrogen or alkyl, R₉ 10 is phenyl, M₃ is halogen, alkyl or alkoxy, l is from 1 to 3, m is from 0 to 3, n is from 0 to 1, and w is from 1 to 2. The number of substituents M₃ may be one or more, and when it is more than one, a plurality of M₃ may be the same or different.

15 (i) The acrylonitrile compound of the formula (I) or its salt, wherein the formula (I) is the formula (I-1):



20

wherein Q is Qa or Qb, R_{2a} is haloalkyl, R_{2b} is halogen, alkyl or haloalkyl, d is from 0 to 2, m is from 0 to 3, and n is from 0 to 1. When d is 2, two R_{2b} may be the same or different.

25 (j) The acrylonitrile compound or its salt according to the above (i), wherein Q is Qa.

(k) The acrylonitrile compound or its salt according

to the above (i), wherein d is 0.

(l) The acrylonitrile compound or its salt according to the above (j), wherein d is 0.

(m) The acrylonitrile compound or its salt according to the above (i), (j), (k) or (l), wherein R_1 is alkoxyalkyl, $-C(=O)R_5$, $-C(=S)R_5$, $-S(O)_wR_5$ or $-CH_2R_9$, R_2 is halogen, alkyl or haloalkyl, R_3 is halogen or alkyl, R_5 is alkyl, haloalkyl, alkoxyalkyl, alkoxy, haloalkoxy, alkylthio, haloalkylthio, alkoxycarbonylalkylthio, alkenylthio, $-N(R_7)R_8$, phenyl which may be substituted by M_3 , phenoxy which may be substituted by M_3 , phenylthio which may be substituted by M_3 , benzyl which may be substituted by M_3 , pyridyl which may be substituted by M_3 , 1-pyrrolidinyl or 4-morpholino, each of R_7 and R_8 is hydrogen or alkyl, R_9 is phenyl, M_3 is halogen, alkyl or alkoxy, l is from 1 to 3, m is from 0 to 3, n is from 0 to 1, and w is from 1 to 2.

In the compounds of the formula (I) or (a) to (m), the alkyl or alkyl moiety contained in R_1 , R_2 , R_{2a} , R_{2b} , R_3 , R_4 , R_5 , R_6 , R_7 , R_8 , R_{10} , M_1 , M_2 or M_3 , may, for example, be straight chain or branched one having from 1 to 6 carbon atoms such as methyl, ethyl, propyl, isopropyl, butyl, tert-butyl, pentyl or hexyl. The alkenyl, alkynyl, alkenyl moiety or alkynyl moiety contained in R_1 , R_2 , R_3 or R_5 , may, for example, be straight chain or branched one having from 2 to 6 carbon atoms, such as vinyl, allyl, butadienyl, isopropenyl,

ethynyl, propinyl or 2-penten-4-enyl. The cycloalkyl or cycloalkyl moiety contained in R_5 , may, for example, be one having from 3 to 6 carbon atoms, such as cyclopropyl, cyclopentyl or cyclohexyl.

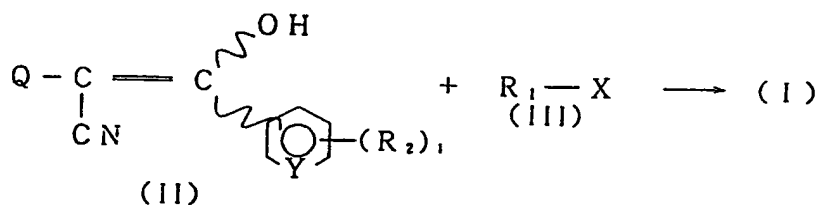
5 In the compounds of the formula (I) or (a) to (m), the halogen contained in R_1 , R_2 , R_{2a} , R_{2b} , R_3 , R_4 , R_6 , M_1 , M_2 or M_3 , or the halogen as a substituent, may be fluorine, chlorine, bromine or iodine. The number of halogens as substituents may be one or more, and when it
10 is more than one, a plurality of halogens may be the same or different.

The acrylonitrile compound of the formula (I) is capable of forming a salt. Such a salt may be any salt so long as it is acceptable for agriculture. For
15 example, it may be an inorganic salt such as a hydrochloride, a sulfate or a nitrate, or an organic salt such as an acetate or a methanesulfonate.

The acrylonitrile compound of the formula (I) may have geometrical isomers (E-isomer and Z-isomer). The
20 present invention includes such isomers and their mixtures.

The acrylonitrile compound of the formula (I) or its salt (hereinafter referred to simply as the compound of the present invention) can be produced, for example, by
25 reactions (A) to (C) and by a usual process for producing a salt.

(A)



5

Now, the reaction (A) will be described.

In the reaction (A), Q, Y, R₁, R₂, l and the formula (I) are as defined above, and X is halogen.

The reaction (A) is carried out usually in the presence of a base. As such a base, one or more may suitably be selected for use from e.g. alkali metals such as sodium and potassium; alkali metal alcoholates such as potassium tertiary butoxide; carbonates such as potassium carbonate and sodium carbonate; bicarbonates such as potassium bicarbonate and sodium bicarbonate; metal hydroxides such as potassium hydroxide and sodium hydroxide; metal hydrides such as potassium hydride and sodium hydride; and tertiary amines such as trimethylamine, triethylamine, pyridine and 4-dimethylaminopyridine.

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The reaction (A) may be carried out, if necessary, in the presence of a solvent. Such a solvent may be any solvent so long as it is inert to the reaction. For example, one or more may be suitably selected for use from e.g. aromatic hydrocarbons such as benzene, toluene, xylene and chlorobenzene; cyclic or non-cyclic aliphatic hydrocarbons such as carbon tetrachloride, methyl

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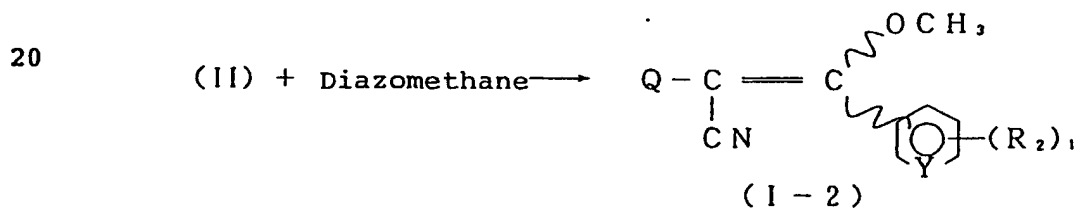
chloride, chloroform, dichloromethane, dichloroethane, trichloroethane, hexane and cyclohexane; ethers such as dioxane, tetrahydrofuran and diethyl ether; esters such as methyl acetate and ethyl acetate; dipolar aprotic
 5 solvents such as dimethylsulfoxide, sulfolane, dimethylacetamide, dimethylformamide, N-methylpyrrolidone and pyridine; nitriles such as acetonitrile, propionitrile and acrylonitrile; ketones such as acetone and methyl ethyl ketone; tertiary amines such as
 10 trimethylamine and triethylamine; and water.

For the reaction (A), a catalyst such as 4-dimethylaminopyridine may be used, as the case requires.

The reaction temperature for the reaction (A) is usually from -80 to +150°C, preferably from -50 to
 15 +120°C, and the reaction time is usually from 0.1 to 48 hours, preferably from 0.5 to 24 hours.

In a case where in the formula (I), R_1 is methyl:

(B)



The reaction (B) will be described in detail. In the
 25 reaction (B), Q, Y, R_2 , 1 and the formula (II) are as defined above.

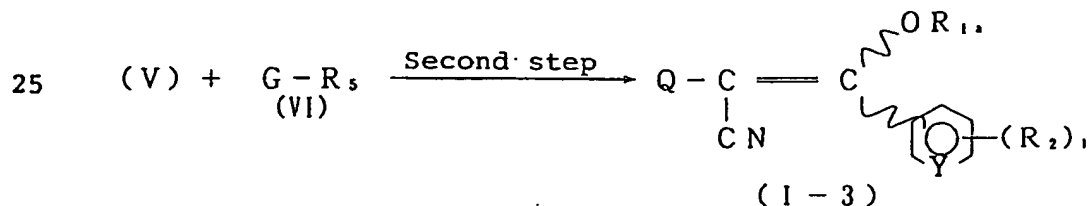
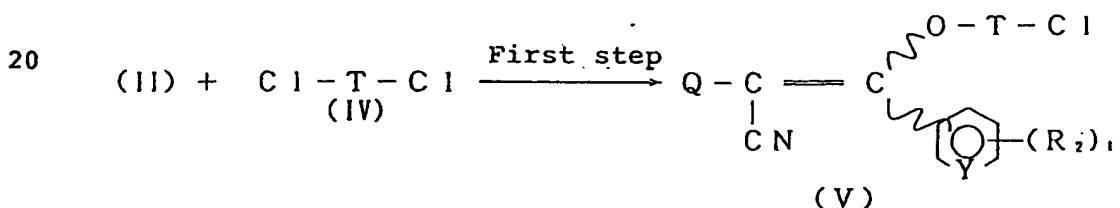
The reaction (B) is carried out usually in the

presence of a solvent. As such a solvent, one or more may suitably be selected for use from e.g. aromatic hydrocarbons such as benzene, toluene, xylene and chlorobenzene; cyclic or non-cyclic aliphatic hydrocarbons such as carbon tetrachloride, methyl chloride, chloroform, dichloromethane, dichloroethane, trichloroethane, hexane and cyclohexane; ethers such as dioxane, tetrahydrofuran and diethyl ether; esters such as methyl acetate and ethyl acetate; nitriles such as acetonitrile, propionitrile and acrylonitrile; and ketones such as acetone and methyl ethyl ketone.

The reaction temperature for the reaction (B) is usually from 0 to 100°C, preferably from 0 to 50°C, and the reaction time is usually from 0.1 to 24 hours, preferably from 0.1 to 12 hours.

In a case where in the formula (I), R_1 is $-C(=O)R_5$, $-C(=S)R_5$ or $-S(O)_wR_5$:

(C)



The reaction (C) will be described. In the reaction (C), Q, Y, R₂, R₅, l and the formula (II) are as defined above, T is -C(=O)-, -C(=S)- or -S(O)_w-, G is hydrogen, Li, MgBr, MgCl or MgI, and R_{1a} is -C(=O)R₅, -C(=S)R₅ or
5 -S(O)_wR₅ (wherein R₅ and w are as defined above).

The first step in the reaction (C) is carried out, if necessary, in the presence of a base. As such a base, one or more may suitably be selected for use from e.g. tertiary amines such as trimethylamine, triethylamine,
10 pyridine and 4-dimethylaminopyridine.

The first step of the reaction (C) is carried out usually in the presence of a solvent. Such a solvent may be any solvent so long as it is inert to the reaction. For example, one or more may suitably selected for use
15 from e.g. aromatic hydrocarbons such as benzene, toluene, xylene and chlorobenzene; cyclic or non-cyclic aliphatic hydrocarbons such as carbon tetrachloride, methyl chloride, chloroform, dichloromethane, dichloroethane, trichloroethane, hexane and cyclohexane; ethers such as
20 dioxane, tetrahydrofuran and diethyl ether; and esters such as methyl acetate and ethyl acetate.

The reaction temperature for the first step of the reaction (C) is usually from -80 to +150°C, preferably from -50 to +80°C, and the reaction time is usually from
25 0.1 to 48 hours, preferably from 0.5 to 24 hours. The compound of the formula (V) prepared by the first step of the reaction (C) is a novel intermediate compound useful

in the present invention.

The second step of the reaction (C) is carried out, if necessary, in the presence of a base. As such a base, one or more may suitably be selected for use from e.g.

5 carbonates such as potassium carbonate and sodium carbonate; and tertiary amines such as trimethylamine, triethylamine, pyridine and 4-dimethylaminopyridine.

The second step of the reaction (C) is carried out usually in the presence of a solvent. Such a solvent may
10 be any solvent so long as it is inert to the reaction.

For example, one or more may suitably be selected for use from e.g. aromatic hydrocarbons such as benzene, toluene, xylene and chlorobenzene; cyclic or non-cyclic aliphatic hydrocarbons such as carbon tetrachloride, methyl
15 chloride, chloroform, dichloromethane, dichloroethane, trichloroethane, hexane and cyclohexane; ethers such as dioxane, tetrahydrofuran and diethyl ether; esters such as methyl acetate and ethyl acetate; nitriles such as acetonitrile, propionitrile and acrylonitrile; and
20 ketones such as acetone and methyl ethyl ketone.

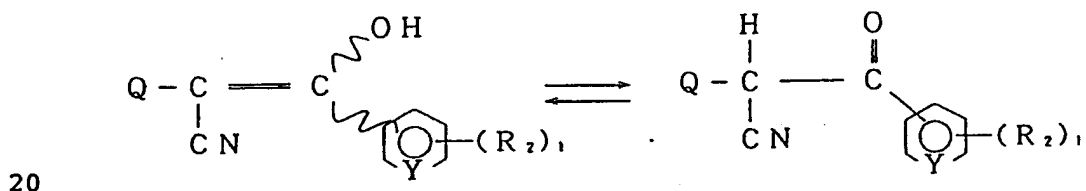
The reaction temperature for the second step of the reaction (C) is usually from -80 to +150°C, preferably from -80 to +80°C, and the reaction time is usually from 0.1 to 48 hours, preferably from 0.5 to 24 hours.

25 The compounds of the formula (II) in the above reactions (A) to (C) are intermediate compounds useful for producing the compounds of the present invention, and

novel compounds are included therein.

The compound of the formula (II) may form a salt. Such a salt may be any salt so long as it is agriculturally acceptable. For example, it may be an
 5 inorganic salt such as a hydrochloride, a sulfate or a nitrate; an organic salt such as an acetate or a methane sulfonate, an alkali metal salt such as a sodium salt or a potassium salt; an alkaline earth metal salt such as a magnesium salt or a calcium salt; or a quaternary
 10 ammonium salt such as dimethylammonium or triethylammonium.

The compound of the formula (II) has geometrical isomers (E-isomer and Z-isomer). The present invention includes such isomers and mixtures thereof. The compound
 15 of the formula (II) may also be present in the form of tautomers represented by the following formula:

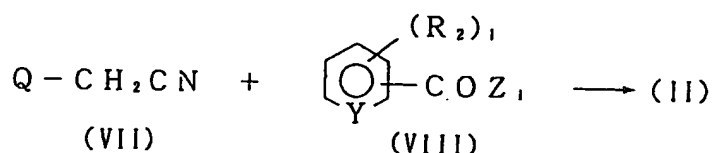


The present invention includes such tautomers and mixtures thereof.

Further, the compounds of the formula (II) include those which exhibit pesticidal activities.

25 The compound of the formula (II) or its salt may be prepared e.g. by reactions (D) to (F), or by a conventional method for producing a salt.

(D)



5 The reaction (D) will be described. In the reaction (D), Q, Y, R₂, l and the formula (II) are as defined above, and Z₁ is alkoxy.

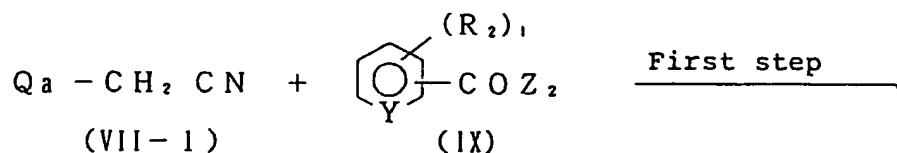
 The reaction (D) is carried out usually in the presence of a base and a solvent. As such a base, one or
 10 more may suitably be selected for use from e.g. alkali metals such as sodium and potassium; alkali metal alcoholates such as sodium methylate, sodium ethylate and potassium tertiary butoxide; metal hydrides such as
 potassium hydride and sodium hydride; and organic lithium
 15 such as methyllithium, butyllithium, tert-butyllithium and phenyllithium. As the solvent, one or more may suitably be selected for use from e.g. aromatic hydrocarbons such as benzene, toluene, xylene and chlorobenzene; ethers such as dioxane, tetrahydrofuran and diethyl ether; and
 20 alcohols such as methanol, ethanol, propanol and tert-butanol.

 The reaction temperature for the reaction (D) is usually from -80 to +150°C, preferably from -50 to +120°C, and the reaction time is usually from 0.1 to 48
 25 hours, preferably from 0.5 to 24 hours.

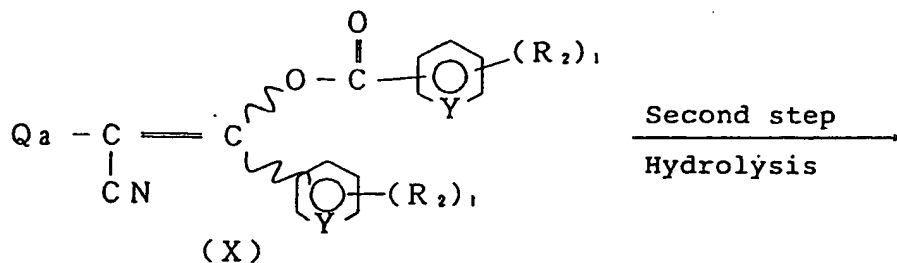
 In a case where in the formula (II), Q is Qa:

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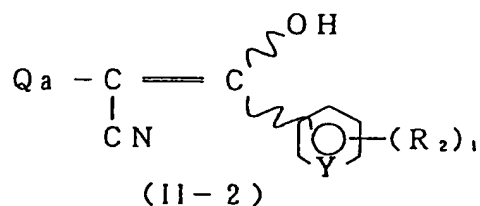
(E)



5



10



The reaction (E) will be described as follows. In the reaction (E), Qa, Y, R₂ and l are as defined above, and Z₂ is halogen.

The first step of the reaction (E) is carried out usually in the presence of a base. As such a base, one or more may suitably be selected for use from e.g. alkali metals such as sodium and potassium; alkali metal alcoholates such as sodium methylete, sodium ethylete and potassium tertiary butoxide; carbonates such as potassium carbonate and sodium carbonate; bicarbonates such as potassium bicarbonate and sodium bicarbonate; metal hydroxides such as potassium hydroxide and sodium hydroxide, metal hydrides such as potassium hydride and sodium hydride; amines such as monomethylamine,

dimethylamine and trimethylamine; and pyridines such as pyridine and 4-dimethylaminopyridine.

The first step of the reaction (E) is carried out, if necessary, in the presence of a solvent. Such a solvent
5 may be any solvent so long as it is inert to the reaction. For example, one or more may suitably be selected for use from e.g. aromatic hydrocarbons such as benzene, toluene, xylene and chlorobenzene; cyclic or non-cyclic aliphatic hydrocarbons such as carbon
10 tetrachloride, methyl chloride, chloroform, dichloromethane, dichloroethane, trichloroethane, hexane and cyclohexane; ethers such as dioxane, tetrahydrofuran and diethyl ether; esters such as methyl acetate and ethyl acetate; dipolar aprotic solvents such as
15 dimethylsulfoxide, sulfolane, dimethylacetamide, dimethylformamide, N-methylpyrrolidone and pyridine; ketones such as acetone and methyl ethyl ketone; amines such as monomethylamine, dimethylamine and triethylamine; and water.

20 For the first step of the reaction (E), a catalyst such as 4-dimethylaminopyridine may be used, as the case requires.

The reaction temperature for the first step of the reaction (E) is usually from -80 to +150°C, preferably
25 from -50 to +120°C, and the reaction time is usually from 0.1 to 48 hours, preferably from 0.5 to 24 hours.

The compound of the formula (X) prepared by the first

step of the reaction (E) is a novel intermediate compound useful in the present invention and at the same time includes a compound of the present invention.

Accordingly, the compound of the present invention can be prepared also by the first step of the reaction (E).

The second step of the reaction (E) is a hydrolysis reaction which is carried out usually in the presence of a base or an acid. As the base, one or more may suitably be selected for use from e.g. carbonates such as potassium carbonate and sodium carbonate; metal hydroxides such as potassium hydroxide and sodium hydroxide; and amines such as monomethylamine, dimethylamine and triethylamine. As the acid, one or more may suitably be selected for use from e.g. inorganic acids such as hydrochloric acid and sulfuric acid; and organic acids such as acetic acid.

The second step of the reaction (E) is carried out, if necessary, in the presence of a solvent. Such a solvent may be any solvent so long as it is inert to the reaction. For example, one or more may suitably be selected for use from e.g. nitriles such as acetonitrile, propionitrile and acrylonitrile; alcohols such as methanol, ethanol, propanol and tert-butanol; organic acids such as acetic acid and propionic acid; aqueous ammonia; and water.

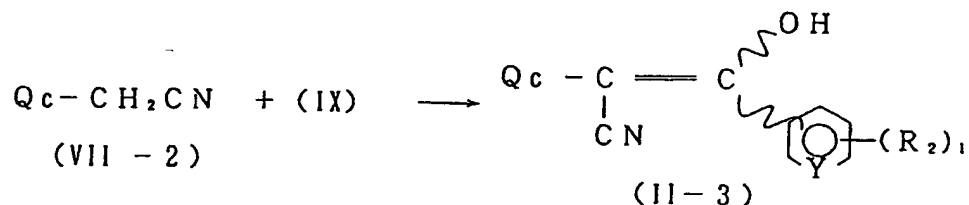
The reaction temperature for the second step of the reaction (E) is usually from 0 to 100°C, preferably from

0 to 50°C, and the reaction time is usually from 0.1 to 48 hours, preferably from 0.5 to 24 hours.

In a case where in the formula (II), Q is Qc:

(F)

5

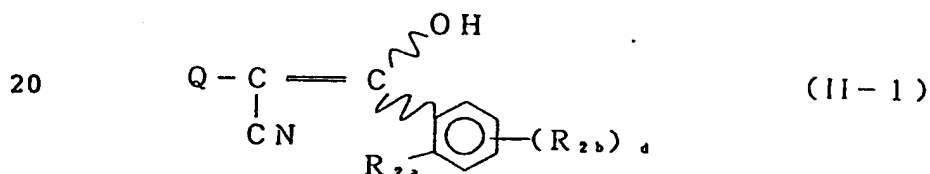


10 The reaction (F) will be described as follows. In the reaction (F), Qc, Y, R₂, l and the formula (IX) are as defined above.

The reaction (F) is carried out in accordance with the first step of the reaction (E).

15 Among compounds of the formula (II) thus prepared, the following compounds are particularly useful and novel.

Compounds of the formula (II-1) or their salts:



20 wherein Q, R_{2a}, R_{2b} and d are as defined above, provided that when Q is Qc, (1) q is not 0, or (2) R₃ is not alkyl.

25 Particularly preferred compounds among the compounds of the formula (II-1) are as follows.

(n) A compound of the above formula (II-1) wherein Q is Qa or Qb, or its salts.

(o) A compound of the above formula (II-1) wherein Q is Qa, or its salt.

5 (p) A compound of the above formula (II-1), (n) or (o) wherein d is 0, or its salt.

The compounds of the present invention are useful as active ingredients for pesticides. They are particularly useful as active ingredients of pesticides such as an
10 insecticide, a miticide, a nematocide, a soil pesticide, a fungicide and a marine antifouling agent.

Preferred embodiments of pesticides containing the compounds of the present invention will now be described. Firstly, pesticides such as an insecticide, a miticide, a
15 nematocide, a soil pesticide and a fungicide, will be described.

The pesticides containing the compounds of the present invention are useful as an insecticide, a miticide, a nematocide and a soil pesticide (hereinafter referred to as insect pest control agents), and they are effective for controlling plant parasitic mites such as two-spotted spider mite (Tetranychus urticae), carmine spider mite (Tetranychus cinnabarinus), kanzawa spider mite (Tetranychus kanzawai), citrus red mite (Panonychus citri),
20 European red mite (Panonychus ulmi), broad mite (Polyphagotarsonemus latus), pink citrus rust mite (Aculops pelekassi) and bulb mite (Rhizoglyphus

echinopus); animal parasitic mites such as Ixodes; aphids such as green peach aphid (Myzus persicae) and cotton aphid (Aphis gossypii); agricultural insect pests such as diamondback moth (Plutella xylostella), cabbage armyworm
5 (Mamestra brassicae), common cutworm (Spodoptera litura), codling moth (Laspeyresia pomonella), bollworm (Heliothis zea), tobacco budworm (Heliothis virescens), gypsy moth (Lymantria dispar), rice leafroller (Cnaphalocrocis medinalis), Adoxophyes sp., colorado potato beetle
10 (Leptinotarsa decemlineata), cucurbit leaf beetle (Aulacophora femoralis), boll weevil (Anthonomus grandis), planthoppers, leafhoppers (Circulifer sp.), scales, bugs, whiteflies, thrips, grasshoppers, anthomyiid flies, scarabs, black cutworm (Agrotis
15 ipsilon), cutworm (Agrotis segetum) and ants; plant parasitic nematodes such as root-knot nematodes, cyst nematodes, root-lesion nematodes, rice white-tip nematode (Aphelenchoides besseyi), strawberry bud nematode (Nothotylenchus acris), pine wood nematode
20 (Bursaphelenchus lignicolus); gastropods such as slugs and snails; soil pests such as isopods such as pillbugs (Armadilidium vulgare) and pillbugs (Porcellio scaber); hygienic insect pests such as tropical rat mite (Ornithonyssus bacoti), cockroaches, housefly (Musca
25 domestica) and house mosquito (Culex pipiens); stored grain insect pests such as angoumois grain moth (Sitotroga cerealella), adzuki bean weevil (Callosobruchus

chinensis), red flour beetle (Tribolium castaneum) and mealworms; household goods insect pests such as casemaking clothes moth (Tinea pellionella), black carpet beetle (Anthrenus scrophularidae) and subterranean

5 termites; domestic mites such as mold mite (Tyrophagus putrescentiae), Dermatophagoides farinae and Chelacaropsis moorei; and others such as fleas, lice and flies, which are parasitic to e.g. domestic animals. Among them, the insect pest control agents containing the

10 compounds of the present invention are particularly effective for controlling plant parasitic mites, animal parasitic mites, agricultural insect pests, hygienic insect pests, household goods insect pests, domestic mites or the like. Further, they are effective against

15 insect pests having acquired resistance to organophosphorus, carbamate and/or synthetic pyrethroid insecticides. Moreover, the compounds of the present invention have excellent systemic properties, and by the application of the compounds of the present invention to

20 solid treatment, not only noxious insects, noxious mites, noxious nematodes, noxious gastropods and noxious isopods in soil but also foliage pests can be controlled.

Further, the pesticides containing compounds of the present invention are useful as fungicides. For example,

25 they are effective for controlling diseases, such as blast (Pyricularia oryzae), sheath blight (Rhizoctonia solani) and brown spot (Cochliobolus miyabeanus) against

- rice; powdery mildew (Erysiphe graminis), scab (Gibberella zeae), rust (Puccinia striiformis, P. coronata, P. graminis, P. recondita, P. hordei), snow blight (Typhula sp., Micronectriella nivalis), loose smut
- 5 (Ustilago tritici, U. nuda), eye spot (Pseudocercospora herpotrichoides), leaf blotch (Septoria tritici) and glume blotch (Leptosphaeria nodorum) against cereals; melanose (Diaporthe citri) and scab (Elsinoe fawcetti) against citrus; blossom blight
- 10 (Sclerotinia mali), powdery mildew (Podosphaera leucotricha), alternaria blotch (Alternaria mali) and scab (Venturia inaequalis) against apples; scab (Venturia nashicola) and black spot (Alternaria kikuchiana) against pears; brown rot (Monilinia fructicola), scab
- 15 (Cladosporium carpophilum) and phomopsis rot (Phomopsis sp.) against peaches; anthracnose (Elsinoe ampelina) ripe rot (Glomerella cinquilata), powdery mildew (Uncinula necator) and downy mildew (Plasmopara viticola) against grapes; anthracnose (Gloeosporium kaki) and angular leaf
- 20 spot (Cercospora kaki) against Japanese persimon; anthracnose (Colletotrichum lagenarium), powdery mildew (Sphaerotheca fuliginea), gummy stem blight (Mycosphaella melonis) and downy mildew (Pseudoperonospora cubensis) against cucurbits; early
- 25 blight (Alternaria solani), leaf mold (Cladosporium fulvum) and late blight (Phytophthora infestans) against tomatoes; alternaria leaf spot (Alternaria brassicae)

against crucifer; early blight (Alternaria solani) and late blight (Phytophthora infestans) against potatoes; powdery mildew (Sphaerotheca humuli) against strawberry; gray mold (Botrytis cinerea) and sclerotinial rot

5 (Sclerotinia sclerotiorum) against various crop plants. Further, they are effective also for controlling soil diseases brought about by plant pathogenic fungi such as Fusarium sp., Pythium sp., Rhizoctonia sp., Verticillium sp., and Plasmodiophora sp.

10 Another preferred embodiments of the pesticides containing compounds of the present invention may be agricultural and horticultural pesticides which collectively control the above-mentioned plant parasitic mites, agricultural insect pests, plant parasitic
15 nematodes, gastropods, soil pests, various diseases and various soil diseases.

The pesticide such as the insect pests control agent or the fungicide containing the compound of the present invention, is usually formulated by mixing the compound
20 with various agricultural adjuvants and used in the form of a formulation such as a dust, granules, water-dispersible granules, a wettable powder, a water-based suspension concentrate, an oil-based suspension
concentrate, water soluble granules, an emulsifiable
25 concentrate, a paste, an aerosol or an ultra low-volume formulation. However, so long as it is suitable for the purpose of the present invention, it may be formulated

into any type of formulation which is commonly used in this field. Such agricultural adjuvants include solid carriers such as diatomaceous earth, slaked lime, calcium carbonate, talc, white carbon, kaoline, bentonite, a mixture of kaolinite and sericite, clay, sodium carbonate, sodium bicarbonate, mirabilite, zeolite and starch; solvents such as water, toluene, xylene, solvent naphtha, dioxane, acetone, isophorone, methyl isobutyl ketone, chlorobenzene, cyclohexane, dimethylsulfoxide, dimethylformamide, dimethylacetamide, N-methyl-2-pyrrolidone, and alcohol; anionic surfactants and spreaders such as a salt of fatty acid, a benzoate, an alkylsulfosuccinate, a dialkylsulfosuccinate, a polycarboxylate, a salt of alkylsulfuric acid ester, an alkyl sulfate, an alkylaryl sulfate, an alkyl diglycol ether sulfate, a salt of alcohol sulfuric acid ester, an alkyl sulfonate, an alkylaryl sulfonate, an aryl sulfonate, a lignin sulfonate, an alkyl diphenyl ether disulfonate, a polystyrene sulfonate, a salt of alkylphosphoric acid ester, an alkylaryl phosphate, a styrylaryl phosphate, a salt of polyoxyethylene alkyl ether sulfuric acid ester, a polyoxyethylene alkylaryl ether sulfate, a salt of polyoxyethylene alkylaryl ether sulfuric acid ester, a polyoxyethylene alkyl ether phosphate, a salt of polyoxyethylene alkylaryl phosphoric acid ester, and a salt of a condensate of naphthalene sulfonate with formalin; nonionic surfactants and

spreaders such as a sorbitan fatty acid ester, a glycerin fatty acid ester, a fatty acid polyglyceride, a fatty acid alcohol polyglycol ether, acetylene glycol, acetylene alcohol, an oxyalkylene block polymer, a polyoxyethylene alkyl ether, a polyoxyethylene alkylaryl ether, a polyoxyethylene styrylaryl ether, a polyoxyethylene glycol alkyl ether, a polyoxyethylene fatty acid ester, a polyoxyethylene sorbitan fatty acid ester, a polyoxyethylene glycerin fatty acid ester, a polyoxyethylene hydrogenated castor oil, and a polyoxypropylene fatty acid ester; and vegetable and mineral oils such as olive oil, kapok oil, castor oil, palm oil, camellia oil, coconut oil, sesame oil, corn oil, rice bran oil, peanut oil, cottonseed oil, soybean oil, rapeseed oil, linseed oil, tung oil, and liquid paraffins. Such adjuvants may be selected for use among those known in this field, so long as the purpose of the present invention can thereby be accomplished. Further, various additives which are commonly used, such as a filler, a thickener, an anti-settling agent, an anti-freezing agent, a dispersion stabilizer, a phytotoxicity reducing agent, and an anti-mold agent, may also be employed.

The weight ratio of the compound of the present invention to the various agricultural adjuvants is usually from 0.001:99.999 to 95:5, preferably from 0.005:99.995 to 90:10.

In the actual application of such a formulation, it may be used as it is, or may be diluted to a predetermined concentration with a diluent such as water, and various extenders may be added thereto, as the case
5 requires.

The application of the pesticide such as the insect pest control agent or the fungicide containing the compound of the present invention can not generally be defined, as it varies depending upon the weather
10 conditions, the type of the formulation, the application season, the application site or the types or degree of outbreak of the pest insects. However, it is usually applied in a concentration of the active ingredient being from 0.05 to 800,000 ppm, preferably from 0.5 to 500,000
15 ppm, and the dose per unit area is such that the compound of the present invention is from 0.05 to 10,000 g, preferably from 1 to 5,000 g, per hectare. The application of the insect pest control agent as a preferred embodiment of the pesticide containing the
20 compound of the present invention, can not generally be defined, as it varies depending upon various conditions as mentioned above, but is usually carried out in a concentration of the active ingredient being from 0.1 to 500,000 ppm, preferably from 1 to 100,000 ppm, and the
25 dose per unit area is such that the compound of the present invention is from 0.1 to 10,000 g, preferably from 10 to 1,000 g, per hectare. The application of the

fungicide can not generally be defined, as it varies depending upon various conditions as described above, but is usually carried out in a concentration of the active ingredient being from 0.1 to 500,000 ppm, preferably from 1 to 100,000 ppm, and the dose per unit area is such that the compound of the present invention is from 0.1 to 10,000 g, preferably from 10 to 1,000 g, per hectare. Further, agricultural and horticultural pesticides as another preferred embodiment of pesticides containing the compounds of the present invention may be applied in accordance with the above-described application of insect pest control agents and fungicides. The present invention includes such a method for controlling insect pests by such applications.

Various formulations of pesticides such as insect pest control agents or fungicides containing the compounds of the present invention or their diluted compositions may be applied by conventional methods for application which are commonly employed, such as spraying (e.g. spraying, jetting, misting, atomizing, powder or grain scattering or dispersing in water), soil application (e.g. mixing or drenching), surface application (e.g. coating, powdering or covering) or impregnation to obtain poisonous feed. Further, it is possible to feed domestic animals with a food containing the above active ingredient and to control the outbreak or growth of pests, particularly insect pests, with their

excrements. Furthermore, the active ingredient may also be applied by a so-called ultra low-volume application method. In this method, the composition may be composed of 100% of the active ingredient.

5 Further, the pesticides such as insect pest control agents or fungicides containing compounds of the present invention may be mixed with or may be used in combination with other agricultural chemicals, fertilizers or
10 phytotoxicity-reducing agents, whereby synergistic effects or activities may sometimes be obtained. Such other agricultural chemicals include, for example, a herbicide, an insecticide, a miticide, a nematocide, a soil pesticide, a fungicide, an antiviral agent, an attractant, an antibiotic, a plant hormone and a plant
15 growth regulating agent. Especially, with a mixed pesticide having a compound of the present invention mixed with or used in combination with one or more active compounds of other agricultural chemicals, the application range, the application time, the pesticidal
20 activities, etc. may be improved to preferred directions. The compound of the present invention and the active compounds of other agricultural chemicals may separately be formulated so that they may be mixed for use at the time of application, or they may be formulated together.
25 The present invention includes such a mixed pesticidal composition.

The mixing ratio of the compound of the present

invention to the active compounds of other agricultural chemicals can not generally be defined, since it varies depending upon the weather conditions, the types of formulations, the application time, the application site, the types or degree of outbreak of insect pests, etc., but it is usually within a range of from 1:300 to 300:1, preferably from 1:100 to 100:1, by weight. Further, the dose for the application is such that the total amount of the active compounds is from 0.1 to 5,000 g, preferably from 10 to 3,000 g, per hectare. The present invention includes a method for controlling insect pests by an application of such a mixed pesticide composition.

The active compounds of insect pest control agents such as insecticides, miticides, nematocides or soil pesticides in the above-mentioned other agricultural chemicals, include, for example, (by common names, some of them are still in an application stage) organic phosphate compounds such as Profenofos, Dichlorvos, Fenamiphos, Fenitrothion, EPN, Diazinon, Chlorpyrifos-methyl, Acephate, Prothiofos, Fosthiazate and Phosphocarb; carbamate compounds such as Carbaryl, Propoxur, Aldicarb, Carbofuran, Thiodicarb, Methomyl, Oxamyl, Ethiofencarb, Pirimicarb, and Fenobucarb; nereistoxin derivatives such as Cartap, and Thiocyclam; organic chlorine compounds such as Dicofol, and Tetradifon; organometallic compounds such as Fenbutatin Oxide; pyrethroid compounds such as Fenvalerate,

Permethrin, Cypermethrin, Deltamethrin, Cyhalothrin, Tefluthrin, and Ethofenprox; benzoylurea compounds such as Diflubenzuron, Chlorfluazuron, Teflubenzuron, and Novaluron; juvenile hormone-like compounds such as

5 Methoprene; pyridazinone compounds such as Pyridaben; pyrazole compounds such as Fenpyroximate, Fipronil, and Tebufenpyrad; neonicotinoids such as Imidacloprid, Nitenpyram, Acetamiprid, Diaclofen, and Thiacloprid; hydrazine compounds such as Tebufenozide,

10 Methoxyfenozide, and Chromafenozide; dinitro compounds; organic sulfur compounds; urea compounds; triazine compounds; hydrazone compounds; and other compounds, such as Buprofezin, Hexythiazox, Amitraz, Chlordimeform, Silafluofen, Triazamate, Pymetrozine, Pyrimidifen,

15 Chlorfenapyr, Indoxacarb, Acequinocyl, Etoxazole, and Cyromazin. Further, BT agents, microbial agricultural chemicals such as insect viruses, or antibiotics such as Avermectin, Milbemycin and Spinosad, may be used in admixture or in combination.

20 The active compounds of fungicides among the above-mentioned other agricultural chemicals include, for example, (by common names, some of which are still in an application stage) pyrimidinamine compounds such as Mepanipyrim, Pyrimethanil, and Cyprodinil; azole

25 compounds such as Triadimefon, Bitertanol, Triflumizole, Etaconazole, Propiconazole, Penconazole, Flusilazole, Myclobutanil, Cyproconazole, Terbuconazole, Hexaconazole,

Furconazole-cis, Prochloraz, Metconazole, Epoxiconazole, and Tetraconazole; quinoxaline compounds such as Quinomethionate; dithiocarbamate compounds such as Maneb, Zineb, Mancozeb, Polycarbamate, Propineb; organic
5 chlorine compounds such as Fthalide, Chlorothalonil, and Quintozene; imidazole compounds such as Benomyl, Thiophanate-Methyl, Carbendazim, and 4-chloro-2-cyano-1-dimethylsulfamoyl-5-(4-methylphenyl)imidazole; pyridinamine compounds such as Fluazinam; cyanoacetamide
10 compounds such as Cymoxanil; phenylamide compounds such as Metalaxyl, Oxadixyl, Ofurace, Benalaxyl, Furalaxyl, and Cyprofuram; sulfenic acid compounds such as Dichlofluanid; copper compounds such as cupric hydroxide, and Oxine Copper; isoxazole compounds such as
15 Hydroxyisoxazole; organophosphorus compounds such as Fosetyl-Al, Tolcofos-Methyl, S-benzyl O,O-diisopropylphosphorothioate, O-ethyl S,S-diphenylphosphorodithioate, and aluminummethylhydrogen phosphonate; N-halogenothioalkyl compounds such as
20 Captan, Captafol, and Folpet; dicarboximide compounds such as Procymidone, Iprodione, and Vinclozolin; benzanilide compounds such as Flutolanil, and Mepronil; piperazine compounds such as Triforine; pyrizine compounds such as Pyrifenox; carbinol compounds such as
25 Fenarimol; and Flutriafol; piperidine compounds such as Fenpropidine; morpholine compounds such as Fenpropimorph; organotin compounds such as Fentin Hydroxide, and Fentin

Acetate; urea compounds such as Pencycuron; cinnamic acid compounds such as Dimethomorph; phenylcarbamate compounds such as Diethofencarb; cyanopyrrole compounds such as Fludioxonil, and Fenpiclonil; β -methoxyacrylate compounds
5 such a Azoxystrobin, Kresoxim-Methyl, and Metominofen; oxazolidinedione compounds such as Famoxadone; anthraquinone compounds; crotonic acid compounds; antibiotics; and other compounds, such as Isoprothiolane, Tricyclazole, Pyroquilon, Diclomezine, Pro. benazole,
10 Quinoxifen, Propamocarb Hydrochloride and Spiroxamine.

Now, pesticides like marine antifouling agents will be described.

The marine antifouling agents containing the compounds of the present invention are effective for
15 controlling noxious marine organisms against ships or underwater structures (such as harbour structures, buoys, pipelines, bridges, submarine bases, seabed oilfield drilling installations, water conduits for power plants, fixed shore nets and culturing nets). Specifically, they
20 are effective for preventing the attachment and propagation of plants such as green algae and brown algae, animals such as a barnacle, a serpla, an ascidian, a sea mussel and an oyster, various bacteria called slime, and aquatics such as mold and a diatom, at the
25 bottoms of ships or on underwater structures.

The marine antifouling agents containing the compounds of the present invention provide antifouling

and antislime properties over a long period of time and exhibit excellent effects for preventing the attachment and propagation of noxious marine organisms against ships or underwater structures.

5 The marine antifouling agents containing the compounds of the present invention are usually formulated and used in the form of paint compositions. However, they may be formulated and used in other forms (such as solutions, emulsifiable concentrates, or pellets) as the
10 case requires. Paint vehicles to be used for formulating the compounds of the present invention into coating compositions, may be resin vehicles which are commonly used. For example, a vinyl chloride resin, a vinyl chloride-vinyl acetate copolymer, a vinyl chloride-vinyl
15 isobutyl ether copolymer, a chlorinated rubber resin, a chlorinated polyethylene resin, a chlorinated polypropylene resin, an acrylic resin, a styrene-butadiene resin, a polyester resin, an epoxy resin, a phenol resin, a synthetic rubber, a silicone rubber, a
20 silicone resin, a petroleum resin, a oil and fat resin, a rosin ester resin, a rosin soap or rosin, may be mentioned. Further, as a vehicle having antifouling properties, an acrylic copolymer resin composition containing, as constituting units, an organotin compound
25 salt of an unsaturated mono- or di-carboxylic acid, obtainable by a condensation reaction of (meth)acrylic acid with an organotin compound such as

bis(tributyltin)oxide or triphenyltin hydroxide, or a resin containing a metal element such as copper, zinc or tellurium in its side chains, may, for example, be used.

When the compound of the present invention is
5 formulated as a coating composition, the blend proportion is adjusted so that the compound of the present invention will be contained in an amount of from 0.1 to 60 wt%, preferably from 1 to 40 wt%, based on the entire coating composition.

10 The coating composition containing the compound of the present invention can be prepared by using e.g. a ball mill, a pebble mill, a roll mill or a sand grinder in accordance with a method which is well known in the field of preparing coating materials. Further, the above
15 coating composition may contain a plasticizer, a coloring pigment, an extender pigment, an organic solvent, etc. which are commonly used in this field.

The coating composition containing the compound of the present invention may further contain any other known
20 inorganic or organic antifouling agent, as the case requires. Such an antifouling agent includes, for example, cuprous oxide, copper rhodanide, copper hydroxide, copper naphthenate, metallic copper and various tin compounds and dithiocarbamic acid
25 derivatives, such as tetramethylthiuram monosulfide, tetramethylthiuram disulfide, zinc bis-(dimethyldithiocarbamate), zinc ethylene-

bis(dithiocarbamate), manganese ethylene-
bis(dithiocarbamate), and copper
bis(dimethyldithiocarbamate).

As described in the foregoing, the compound of the
5 present invention or the compound of the formula (II) as
its intermediate, is effective as an active ingredient of
a pesticide. Various embodiments thereof will be
summarized as follows.

(1) A pesticide containing a compound of the above
10 formula (I) or (II), or its salt, as an active
ingredient, or a method for controlling pests by
employing such a compound.

(2) An agricultural and horticultural pesticide
containing a compound of the above formula (I) or (II),
15 or its salt, as an active ingredient, or a method for
controlling pests in an agricultural and horticultural
field by employing such a compound.

(3) An insect pest control agent containing a
compound of the above formula (I) or (II), or its salt,
20 as an active ingredient, or a method for controlling
pests by employing such a compound.

(4) An insecticide containing a compound of the above
formula (I) or (II), or its salt, as an active
ingredient, or a method for controlling noxious insects
25 by employing such a compound.

(5) A miticide containing a compound of the above
formula (I) or (II), or its salt, as an active

ingredients, or a method for controlling mites by employing such a compound.

(6) A nematocide containing a compound of the above formula (I) or (II), or its salt, as an active
5 ingredient, or a method for controlling nematodes by employing such a compound.

(7) A soil pesticide containing a compound of the above formula (I) or (II), or its salt, as an active ingredient, or a method for controlling soil pests by
10 employing such a compound.

(8) A fungicide containing a compound of the above formula (I) or (II), or its salt, as an active ingredient, or a method for controlling fungi by employing such a compound.

15 (9) A marine antifouling agent containing a compound of the above formula (I) or (II), or its salt, as an active ingredient, or a method for controlling marine fouling organisms by employing such a compound.

Now, the present invention will be described in
20 further detail with reference to Examples. However, it should be understood that the present invention is by no means restricted to such specific Examples. Firstly, Examples for preparing compounds of the present invention will be described.

25 PREPARATION EXAMPLE 1

Preparation of β -(2-chlorophenyl)- β -isopropylcarbonyloxy- α -(2-thienyl)acrylonitrile (after-mentioned Compound No.

b-35)

1) 1.12 g of sodium was added to 25 ml of dry ethanol, followed by heating to a reflux temperature. Then, a mixture comprising 5.0 g of 2-thiopheneacetonitrile, 7.49
5 g of ethyl 2-chlorobenzoate and 25 ml of dry ethanol, was dropwise added. After completion of the dropwise addition, the mixture was reacted for 1 hour under reflux.

After completion of the reaction, the reaction
10 mixture was cooled and put into water, and the aqueous layer washed with methylene chloride was weakly acidified with hydrochloric acid and extracted with methylene chloride. The obtained extracted layer was dried over anhydrous sodium sulfate and concentrated under reduced
15 pressure to obtain 1.6 g of β -(2-chlorophenyl)- β -hydroxy- α -(2-thienyl)acrylonitrile having a melting point of from 164 to 167°C. The NMR spectrum data of this compound were as follows.

$^1\text{H-NMR}$ δ ppm (Solvent: CDCl_3 /400 MHz)

20 6.54(s,1H), 7.18(dd,1H), 7.38-7.60(m,5H), 7.57(dd,1H)

2) 46 mg of triethylamine was added to a mixture comprising 0.12 g of β -(2-chlorophenyl)- β -hydroxy- α -(2-thienyl)acrylonitrile and 5 ml of dichloroethane, followed by cooling with ice. Then, a mixture comprising
25 54 mg of isobutyl chloride and 2 ml of dichloroethane, was dropwise added. After completion of the dropwise addition, the mixture was returned to room temperature

and reacted for 1.5 hours.

After completion of the reaction, the reaction mixture was put into water and extracted with methylene chloride. The extracted layer was washed with water, dried over anhydrous sodium sulfate and then concentrated under reduced pressure. The obtained residue was purified by silica gel column chromatography (developing solvent: ethyl acetate/n-hexane = 1/4) to obtain 0.12 g of the desired product having a melting point of from 84 to 86°C. The NMR spectrum data of this product were as follows.

¹H-NMR δppm (Solvent: CDCl₃/400 MHz)

1.27(d,6H), 2.90(m,1H), 7.11(dd,1H), 7.33-7.40(m,2H),
7.45(d,2H), 7.52(d,1H), 7.65(dd,1H)

15 PREPARATION EXAMPLE 2

Preparation of α-(2,4-dichlorophenyl)-β-ethylsulfonyloxy-β-(2-trifluoromethylphenyl)acrylonitrile (after-mentioned Compound No. a-63)

1) A mixture comprising 3.7 g of 2-trifluoromethylbenzoyl chloride and 15 ml of toluene, were dropwise added with stirring at room temperature to a mixture comprising 3.0 g of 2,4-dichlorophenylacetonitrile, 45 ml of toluene, 1.63 g of triethylamine and 0.1 g of 4-dimethylaminopyridine. After completion of the dropwise addition, the mixture was reacted for 2 hours under reflux.

After completion of the reaction, the reaction

mixture was cooled, put into water and extracted with methylene chloride. The obtained extracted layer was washed with water, dried over anhydrous sodium sulfate and then concentrated under reduced pressure to obtain

5 6.13 g of α -(2,4-dichlorophenyl)- β -(2-trifluoromethylphenyl)- β -(2-trifluoromethylbenzoyloxy)acrylonitrile. The NMR spectrum data of this compound were as follows.

$^1\text{H-NMR}$ δ ppm (Solvent: CDCl_3 /400 MHz)

10 7.21-7.45(m,3H), 7.49-7.88(m,8H)

2) 6.13 g of α -(2,4-dichlorophenyl)- β -(2-trifluoromethylphenyl)- β -(2-

trifluoromethylbenzoyloxy)acrylonitrile obtained in the above step, was, without purification, dissolved in 90 ml
15 of ethanol. A mixture comprising 0.69 g of sodium hydroxide and 12 ml of water, was added thereto, and the mixture was reacted at room temperature for 2.5 hours.

After completion of the reaction, the reaction mixture was put into water, and the aqueous layer washed
20 with methylene chloride was weakly acidified with hydrochloric acid and extracted with methylene chloride. The obtained extracted layer was washed with water, dried over anhydrous sodium sulfate and then concentrated under reduced pressure to obtain 2.5 g of α -(2,4-
25 dichlorophenyl)- β -hydroxy- β -(2-trifluoromethylphenyl)acrylonitrile (after-mentioned Intermediate No. II-4) having a melting point of from 182

to 183°C. The NMR spectrum data of this compound were as follows.

^1H -NMR δ ppm (Solvent: CDCl_3 /400 MHz)

5.81(s,1H), 7.38-7.48(m,2H), 7.54-7.65(m,1H), 7.66-

5 7.82(m,4H)

3) 0.118 g of ethanesulfonyl chloride was added under cooling with ice to a mixture comprising 0.30 g of α -(2,4-dichlorophenyl)- β -hydroxy- β -(2-trifluoromethylphenyl)acrylonitrile, 7 ml of dichloroethane and 93 mg of triethylamine. Then, the mixture was returned to room temperature and reacted for 15 hours.

After completion of the reaction, the reaction mixture was washed with water, dried over anhydrous sodium sulfate and then concentrated under reduced pressure. The obtained residue was purified by silica gel column chromatography (developing solvent: ethyl acetate/n-hexane = 1/4) to obtain 0.21 g of the desired product having a melting point of from 114 to 116°C. The NMR spectrum data of this product were as follows.

^1H -NMR δ ppm (Solvent: CDCl_3 /400 MHz)

1.14(t,3H), 2.75-2.94(m,2H), 7.40(dd,1H), 7.47(d,1H),

7.57(d,1H), 7.71-7.78(m,2H), 7.85-7.89(m,2H)

PREPARATION EXAMPLE 3

25 Preparation of α -(2,4-dichlorophenyl)- β -methylsulfonyloxy- β -(2-trifluoromethylphenyl)-acrylonitrile (after-mentioned Compound No. a-55)

93 mg of triethylamine was added to a mixture comprising 0.30 g of α -(2,4-dichlorophenyl)- β -hydroxy- β -(2-trifluoromethylphenyl)acrylonitrile and 7 ml of dichloroethane. Then, 96 mg of methanesulfonyl chloride was added thereto, and the mixture was reacted for 17 hours at room temperature.

After completion of the reaction, the reaction mixture was washed with water, dried over anhydrous sodium sulfate and then concentrated under reduced pressure. The obtained residue was purified by silica gel column chromatography (developing solvent: ethyl acetate/n-hexane = 1/6) to obtain 0.13 g of the desired oily product. The NMR spectrum data of this product were as follows.

$^1\text{H-NMR}$ δ ppm (Solvent: CDCl_3 /400 MHz)
2.68(s,3H), 7.38(d,1H), 7.46(d,1H), 7.54(s,1H), 7.70-7.77(m,2H), 7.84-7.89(m,2H)

PREPARATION EXAMPLE 4

Preparation of α -(2,4-dichlorophenyl)- β -(n-propylsulfonyloxy)- β -(2-trifluoromethylphenyl)-acrylonitrile (after-mentioned Compound No. a-67) (Process 1)

93 mg of triethylamine was added to a mixture comprising 0.30 g of α -(2,4-dichlorophenyl)- β -hydroxy- β -(2-trifluoromethylphenyl)acrylonitrile and 7 ml of dichloroethane. Then, 0.13 g of n-propanesulfonyl chloride was added thereto, and the mixture was reacted

for 15 hours at room temperature.

After completion of the reaction, the reaction mixture was washed with water, dried over anhydrous sodium sulfate and then concentrated under reduced pressure. The obtained residue was purified by silica gel column chromatography (developing solvent: ethyl acetate/n-hexane = 1/4) to obtain 0.15 g of the desired oily product. The NMR spectrum data of this product were as follows.

¹H-NMR δppm (Solvent: CDCl₃/400 MHz)
0.87(t,3H), 1.52-1.64(m,2H), 2.65-2.73(m,1H), 2.79-2.86(m,1H), 7.40(dd,1H), 7.47(d,1H), 7.57(d,1H), 7.71-7.78(m,2H), 7.85-7.89(m,2H)

PREPARATION EXAMPLE 5

Preparation of α-(2,4-dichlorophenyl)-β-(n-propylsulfonyloxy)-β-(2-trifluoromethylphenyl)-acrylonitrile (after-mentioned Compound No. a-67) (Process 2)

2.22 g of triethylamine was added to a mixture comprising 5.60 g of α-(2,4-dichlorophenyl)-β-hydroxy-β-(2-trifluoromethylphenyl)acrylonitrile and 50 ml of dichloroethane. Then, a mixture comprising 2.90 g of n-propanesulfonyl chloride and 10 ml of dichloroethane, was dropwise added thereto. After completion of the dropwise addition, the mixture was reacted for 2 hours at room temperature.

After completion of the reaction, the reaction

mixture was washed with water, dried over anhydrous sodium sulfate and then concentrated under reduced pressure. The obtained residue was purified by silica gel column chromatography (developing solvent: ethyl acetate/n-hexane = 1/6) to obtain 2.8 g of the desired product having a melting point of from 95 to 96°C.

PREPARATION EXAMPLE 6

Preparation of α -(4-chlorophenyl)- β -(n-butylsulfonyloxy)- β -(2-trifluoromethylphenyl)acrylonitrile (after-mentioned Compound No. a-156)

1) A mixture comprising 6.19 g of 2-trifluoromethylbenzoyl chloride and 15 ml of toluene, was dropwise added with stirring at room temperature to a mixture comprising 3.0 g of 4-chlorophenylacetonitrile, 30 ml of toluene, 3.0 g of triethylamine and 0.1 g of 4-dimethylaminopyridine. After completion of the dropwise addition, the mixture was reacted for 8 hours under reflux.

After completion of the reaction, the reaction mixture was cooled, put into water and extracted with methylene chloride. The obtained extracted layer was washed with water, dried over anhydrous sodium sulfate and then concentrated under reduced pressure to obtain 3.08 g of α -(4-chlorophenyl)- β -(2-trifluoromethylphenyl)- β -(2-trifluoromethylbenzoyloxy)acrylonitrile.

2) 3.08 g of α -(4-chlorophenyl)- β -(2-trifluoromethylphenyl)- β -(2-

trifluoromethylbenzoyloxy)acrylonitrile obtained in the above step was, without purification, dissolved in 40 ml of ethanol. A mixture comprising 0.50 g of sodium hydroxide and 10 ml of water was added thereto, and the
5 mixture was reacted for 2 hours at room temperature.

After completion of the reaction, the reaction mixture was put into water, and the aqueous layer washed with methylene chloride was weakly acidified with hydrochloric acid and extracted with methylene chloride.
10 The obtained extracted layer was washed with water, dried over anhydrous sodium sulfate and then concentrated under reduced pressure to obtain 1.68 g of α -(4-chlorophenyl)- β -hydroxy- β -(2-trifluoromethylphenyl)acrylonitrile (after-mentioned Intermediate No. II-2) having a melting
15 point of from 146 to 148°C. The NMR spectrum data of this product were as follows.

$^1\text{H-NMR}$ δ ppm (Solvent: CDCl_3 /400 MHz)

7.41(d,2H), 7.58-7.68(m,5H), 7.75(m,1H)

3) 86 mg of triethylamine was added to a mixture
20 comprising 0.25 g of α -(4-chlorophenyl)- β -hydroxy- β -(2-trifluoromethylphenyl)acrylonitrile and 8 ml of dichloroethane. Then, a mixture comprising 0.133 g of n-butanesulfonyl chloride and 2 ml of dichloroethane, was dropwise added thereto. After completion of the dropwise
25 addition, the mixture was reacted for 15 hours at room temperature.

After completion of the reaction, the reaction

mixture was washed with water, and the organic layer was dried over anhydrous sodium sulfate and then concentrated under reduced pressure. The obtained residue was purified by silica gel column chromatography (developing solvent: ethyl acetate/n-hexane = 1/6) to obtain 0.12 g of the desired product having a melting point of from 63 to 64°C. The NMR spectrum data of this product were as follows.

^1H -NMR δ ppm (Solvent: CDCl_3 /400 MHz)

0.78(t,3H), 1.25(m,2H), 1.58(m,2H), 2.78(m,2H),
7.45(d,2H), 7.63(d,2H), 7.72(m,2H), 7.82(m,2H)

PREPARATION EXAMPLE 7

Preparation of α -(4-bromophenyl)- β -(ethylsulfonyloxy)- β -(2-trifluoromethylphenyl)acrylonitrile (after-mentioned Compound No. a-21)

1) A mixture comprising 17.55 g of 2-trifluoromethylbenzoyl chloride and 30 ml of toluene, was dropwise added with stirring at room temperature to a mixture comprising 15.0 g of 4-bromophenylacetonitrile, 120 ml of toluene, 8.52 g of triethylamine and 0.5 g of 4-dimethylaminopyridine. After completion of the dropwise addition, the mixture was reacted for 4 hours under reflux.

After completion of the reaction, the reaction mixture was cooled, put into water and extracted with methylene chloride. The obtained extracted layer was washed with water, dried over anhydrous sodium sulfate

and then concentrated under reduced pressure to obtain 21.25 g of α -(4-bromophenyl)- β -(2-trifluoromethylphenyl)- β -(2-trifluoromethylbenzoyloxy)acrylonitrile.

- 5 2) 21.25 g of α -(4-bromophenyl)- β -(2-trifluoromethylphenyl)- β -(2-trifluoromethylbenzoyloxy)acrylonitrile obtained in the above step was, without purification, dissolved in 60 ml of ethanol. Then, a mixture comprising 2.36 g of sodium
10 hydroxide and 15 ml of water, was added thereto, and the mixture was reacted for 2 hours at room temperature.

After completion of the reaction, the reaction mixture was put into water, and the aqueous layer washed with methylene chloride was weakly acidified with
15 hydrochloric acid and extracted with methylene chloride. The obtained extracted layer was washed with water, dried over anhydrous sodium sulfate and then concentrated under reduced pressure to obtain 9.52 g of α -(4-bromophenyl)- β -hydroxy- β -(2-trifluoromethylphenyl)acrylonitrile (after-
20 mentioned Intermediate No. II-3) having a melting point of from 168 to 173°C.

- 3) 91 mg of triethylamine was added to a mixture comprising 0.30 g of α -(4-bromophenyl)- β -hydroxy- β -(2-trifluoromethylphenyl)acrylonitrile and 8 ml of
25 dichloroethane. Then, a mixture comprising 0.11 g of ethanesulfonyl chloride and 2 ml of dichloroethane, was dropwise added thereto. After completion of the dropwise

addition, the mixture was reacted for 15 hours at room temperature.

After completion of the reaction, the reaction mixture was washed with water, and the organic layer was
5 dried over anhydrous sodium sulfate and then concentrated under reduced pressure. The obtained residue was purified by silica gel column chromatography (developing solvent: ethyl acetate/n-hexane = 1/4) to obtain 0.14 g of the desired product having a melting point of from 131
10 to 132°C. The NMR spectrum data of this product were as follows.

$^1\text{H-NMR}$ δ ppm (Solvent: CDCl_3 /400 MHz)

1.23(t,3H), 2.85(m,2H), 7.56-7.62(m,4H), 7.71(m,2H),
7.83(m,2H)

15 PREPARATION EXAMPLE 8

Preparation of α -(4-bromophenyl)- β -(n-propylsulfonyloxy)- β -(2-trifluoromethylphenyl)acrylonitrile (after-mentioned Compound No. a-22)

60 mg of triethylamine was added to a mixture
20 comprising 0.20 g of α -(4-bromophenyl)- β -hydroxy- β -(2-trifluoromethylphenyl)acrylonitrile and 6 ml of dichloroethane. Then, a mixture comprising 77 mg of n-propanesulfonyl chloride and 2 ml of dichloroethane, was dropwise added thereto. After completion of the dropwise
25 addition, the mixture was reacted for 15 hours at room temperature.

After completion of the reaction, the reaction

mixture was washed with water, and the organic layer was dried over anhydrous sodium sulfate and then concentrated under reduced pressure. The obtained residue was purified by silica gel column chromatography (developing
5 solvent: ethyl acetate/n-hexane = 1/9) to obtain 0.10 g of the desired oily product. The NMR spectrum data of this product were as follows.

^1H -NMR δ ppm (Solvent: CDCl_3 /400 MHz)

0.86(t,3H), 1.65(m,2H), 2.76(m,2H), 7.56-7.63(m,4H),
10 7.71(m,2H), 7.81(m,2H)

PREPARATION EXAMPLE 9

Preparation of α -(4-bromophenyl)- β -(n-butylsulfonyloxy)- β -(2-trifluoromethylphenyl)acrylonitrile (after-mentioned Compound No. a-23)

15 60 mg of triethylamine was added to a mixture comprising 0.20 g of α -(4-bromophenyl)- β -hydroxy- β -(2-trifluoromethylphenyl)acrylonitrile and 6 ml of dichloroethane. Then, a mixture comprising 85 mg of n-butanesulfonyl chloride and 2 ml of dichloroethane, was
20 dropwise added thereto. After completion of the dropwise addition, the mixture was reacted for 15 hours at room temperature.

After completion of the reaction, the reaction mixture was washed with water, and the organic layer was
25 dried over anhydrous sodium sulfate and then concentrated under reduced pressure. The obtained residue was purified by silica gel column chromatography (developing

solvent: ethyl acetate/n-hexane = 1/9) to obtain 70 mg of the desired oily product. The NMR spectrum data of this product were as follows.

¹H-NMR δppm (Solvent: CDCl₃/400 MHz)

5 0.78(t,3H), 1.23(m,2H), 1.59(m,2H), 2.78(m,2H), 7.57-
7.63(m,4H), 7.71(m,2H), 7.82(m,2H)

PREPARATION EXAMPLE 10

Preparation of α-(4-chlorophenyl)-β-

(dimethylthiocarbamoyloxy)-β-(2-trifluoromethylphenyl)-
10 acrylonitrile (after-mentioned Compound No. a-316)

A mixed solution comprising 0.42 g of dimethylthiocarbamoyl chloride and 5 ml of acetonitrile, was dropwise added at room temperature to a mixed solution comprising 1.0 g of α-(4-chlorophenyl)-β-
15 hydroxy-β-(2-trifluoromethylphenyl)acrylonitrile, 0.47 g of triethylamine, a catalytic amount of 4-dimethylaminopyridine and 20 ml of acetonitrile. After completion of the dropwise addition, the mixture was reacted for 2 hours at 50°C.

20 After completion of the reaction, acetonitrile was distilled off under reduced pressure. Ethyl acetate and water were added to the residue to carry out extraction. The organic layer was washed with water and a saturated sodium chloride aqueous solution and dried over anhydrous
25 magnesium sulfate. Then, the solvent was distilled off, and the residue was purified by silica gel column chromatography (developing solvent: ethyl acetate/n-

hexane = 1/4) to obtain 0.82 g of the desired product having a melting point of 137.9°C. The NMR spectrum data of this product were as follows.

^1H -NMR δ ppm (Solvent: CDCl_3 /400 MHz)

5 3.10(s,3H), 3.22(s,3H), 7.35-8.15(m,8H)

PREPARATION EXAMPLE 11

Preparation of α -(4-chlorophenyl)- β -(S-ethylthiocarbonyloxy)- β -(2-trifluoromethylphenyl)-acrylonitrile (after-mentioned Compound No. a-306)

10 A mixed solution comprising 500 mg of α -(4-chlorophenyl)- β -hydroxy- β -(2-trifluoromethylphenyl)acrylonitrile and 2 ml of N,N-dimethylformamide were dropwise added under cooling with ice to a mixture comprising 68 mg of 60% sodium hydride
15 and 10 ml of N,N-dimethylformamide. After completion of the dropwise addition, the mixture was gradually returned to room temperature, and stirring was continued until generation of hydrogen gas completed. Then, the mixture was again cooled with ice, and a mixed solution
20 comprising 240 mg of ethyl chlorodithiocarbonate and 2 ml of N,N-dimethylformamide, was dropwise added. After completion of the dropwise addition, the mixture was reacted for 2 hours at room temperature.

After completion of the reaction, the reaction
25 mixture was poured into 100 ml of ice water and then extracted with 150 ml of ethyl ether. The organic layer was washed with water and a saturated sodium chloride

aqueous solution and dried over anhydrous magnesium sulfate. Then, the solvent was distilled off, and the residue was purified by silica gel column chromatography (developing solvent: ethyl acetate/n-hexane = 1/9) to
5 obtain 380 mg of the desired product having a refractive index $n_D^{27.2}$ of 1.5612. The NMR spectrum data of this product were as follows.

^1H -NMR δ ppm (Solvent: CDCl_3 /400 MHz)

1.29(t, 3H, J=7.80 Hz), 3.08(q, 2H, J=7.80 Hz), 7.01-
10 7.93(m, 8H)

PREPARATION EXAMPLE 12

Preparation of α -(4-chlorophenyl)- β -(diethylaminosulfonyloxy)- β -(2-trifluoromethylphenyl)-acrylonitrile (after-mentioned Compound No. a-286)

15 0.18 g of triethylamine was added to a mixture comprising 0.3 g of α -(4-chlorophenyl)- β -hydroxy- β -(2-trifluoromethylphenyl)acrylonitrile and 5 ml of dichloroethane. Then, 0.27 g of diethylsulfamoyl chloride was added thereto, and the mixture was reacted
20 for 3 hours under reflux.

After completion of the reaction, water was put into the reaction mixture and extracted with methylene chloride. The extracted organic layer was washed with water and dried over anhydrous sodium sulfate. Then, it
25 was concentrated under reduced pressure, and the obtained residue was purified by silica gel column chromatography (developing solvent: ethyl acetate/n-hexane = 15/85) to

obtain 78 mg of the desired oily product. The NMR spectrum data of this product were as follows.

^1H -NMR δ ppm (Solvent: CDCl_3 /400 MHz)

1.05(t,6H), 3.06(m,4H), 7.42(d,2H), 7.57(d,2H), 7.63-
5 7.80(m,4H)

PREPARATION EXAMPLE 13

Preparation of α -(4-chlorophenyl)- β -(S-methyldithiocarbonyloxy)- β -(2-trifluoromethylphenyl)-acrylonitrile (after-mentioned Compound No. a-305)

10 A mixed solution comprising 800 mg of α -(4-chlorophenyl)- β -hydroxy- β -(2-trifluoromethylphenyl)acrylonitrile and 2 ml of N,N-dimethylformamide were dropwise added under cooling with ice to a mixture comprising 110 mg of 60% sodium hydride
15 and 10 ml of N,N-dimethylformamide. After completion of the dropwise addition, the mixture was gradually returned to room temperature, and the stirring was continued until generation of hydrogen gas completed. Then, the mixture was cooled again with ice, and a mixed solution
20 comprising 340 mg of methyl chlorodithiocarbonate and 2 ml of N,N-dimethylformamide, was dropwise added thereto. After completion of the dropwise addition, the mixture was reacted for 2 hours at room temperature.

After completion of the reaction, the reaction
25 mixture was poured into 100 ml of ice water. Then, 150 ml of ethyl ether was added thereto for extraction. The organic layer was washed with water and a saturated

sodium chloride aqueous solution and dried over anhydrous magnesium sulfate. Then, the solvent was distilled off, and the residue was purified by silica gel column chromatography (developing solvent: ethyl acetate/n-hexane = 1/9) to obtain 610 mg of the desired product having a refractive index $n_D^{39.4}$ of 1.5930. The NMR spectrum data of this product were as follows.

$^1\text{H-NMR}$ δ ppm (Solvent: CDCl_3 /400 MHz)

2.47(s,3H), 2.53(s,3H), 7.07-7.99(m,8H)

10 PREPARATION EXAMPLE 14

Preparation of α -(4-chlorophenyl)- β -(dimethylaminosulfonyloxy)- β -(2-trifluoromethylphenyl)-acrylonitrile (after-mentioned Compound No. a-218)

1.25 g of triethylamine was added to a mixture comprising 2.0 g of α -(4-chlorophenyl)- β -hydroxy- β -(2-trifluoromethylphenyl)acrylonitrile and 40 ml of dichloroethane. Then, 1.68 g of dimethylsulfonyl chloride was added thereto, and the mixture was reacted for 2 hours under reflux.

20 After completion of the reaction, water was added to the reaction mixture and extracted with methylene chloride. The extracted organic layer was washed with water and dried over anhydrous sodium sulfate. Then, it was concentrated under reduced pressure, and the obtained residue was purified by silica gel column chromatography (developing solvent: ethyl acetate/n-hexane = 15/85) to obtain 2.50 g of the desired product having a melting

point of from 110 to 112°C. The NMR spectrum data of this product were as follows.

^1H -NMR δ ppm (Solvent: CDCl_3 /400 MHz)

2.66(s,6H), 7.43(d,2H), 7.60(d,2H), 7.67-7.82(m,4H)

5 PREPARATION EXAMPLE 15

Preparation of α -(4-chlorophenyl)- β -(ethyldithiooxy)- β -(2-trifluoromethylphenyl)acrylonitrile (after-mentioned Compound No. a-488)

1) 0.109 g of sulfur dichloride was added to a mixture
10 comprising 0.25 g of α -(4-chlorophenyl)- β -hydroxy- β -(2-trifluoromethylphenyl)acrylonitrile and 10 ml of ethyl ether. Then, a mixture comprising 67 mg of pyridine and 10 ml of ethyl ether, was dropwise added thereto at -10°C, and the mixture was returned to room temperature
15 and reacted for 3 hours.

After completion of the reaction, the reaction mixture was filtered, and the filtrate was concentrated under reduced pressure to obtain 0.30 g of α -(4-chlorophenyl)- β -chlorosulfenyloxy- β -(2-trifluoromethylphenyl)acrylonitrile.
20

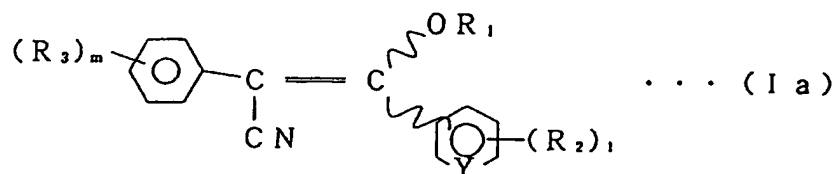
2) 0.30 g of α -(4-chlorophenyl)- β -chlorosulfenyloxy- β -(2-trifluoromethylphenyl)acrylonitrile obtained in the above step was, without purification, dissolved in 10 ml of dichloroethane. Then, 58 mg of ethanethiol was added
25 thereto, and then 94 mg of triethylamine was added thereto under cooling with ice. The mixture was returned to room temperature and reacted for 1 hour.

After completion of the reaction, water was added to the reaction mixture and extracted with methylene chloride. The extracted organic layer was washed with water, dried over anhydrous sodium sulfate and then concentrated under reduced pressure. The obtained residue was purified by silica gel column chromatography (developing solvent: ethyl acetate/n-hexane = 15/85) to obtain 0.20 g of the desired oily product. The NMR spectrum data of this product were as follows.

¹H-NMR δppm (Solvent: CDCl₃/400 MHz)
1.24(t,3H), 2.62-2.79(m,2H), 7.12(d,1H), 7.43(d,2H),
7.49(t,1H), 7.60(d,2H), 7.74(d,1H)

Now, typical examples of the compound of the present invention of the above formula (I) will be shown in Tables 1-a, 1-b, 1-c and 1-d, and typical examples of the intermediate compound of the formula (II) will be shown in Table 2. These compounds can be synthesized in accordance with the above-described Preparation Examples or the above-described various methods for producing the compound of the present invention or its intermediate compound.

Table I-a




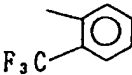

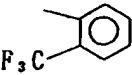

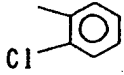

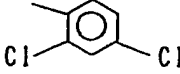

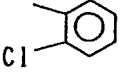

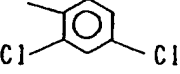

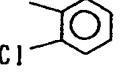

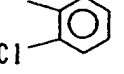

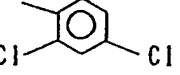
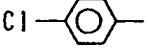
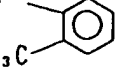
| Comp. No. | $(R_3)_m$ | R_1 | $\text{C}_6\text{H}_3(\text{Y})(R_2)_1$ | Physical Property (Melting point) |
|-----------|---|--|--|-----------------------------------|
| a-1 |  | $-\text{SO}_2\text{CH}_2\text{CH}_3$ |  | 74~75°C |
| a-2 |  | $-\text{SO}_2\text{N}(\text{CH}_3)_2$ |  | 102~104°C |
| a-3 |  | $-\text{COCH}_3$ |  | 98~100°C |
| a-4 |  | $-\text{COCH}_3$ |  | Oily |
| a-5 |  | $-\text{CO}(\text{CH}_2)_2\text{CH}_3$ |  | Oily |
| a-6 |  | $-\text{CO}(\text{CH}_2)_2\text{CH}_3$ |  | Oily |
| a-7 |  | $-\text{COCH}(\text{CH}_3)_2$ |  | Oily |
| a-8 |  | $-\text{COC}(\text{CH}_3)_3$ |  | 83~84°C |
| a-9 |  | $-\text{COC}(\text{CH}_3)_3$ |  | Oily |
| a-10 |  | $-\text{CO}(\text{CH}_2)_2\text{CH}_3$ |  | Oily |

Table I-a (Continued)

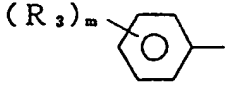

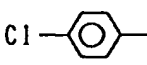
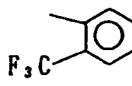
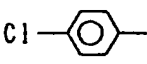
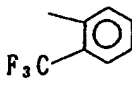
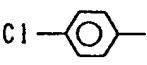
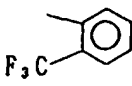
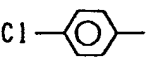
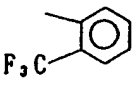
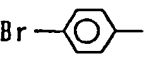
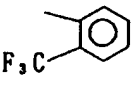
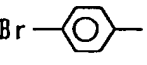
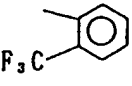
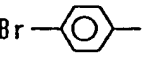
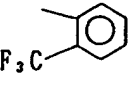
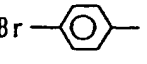
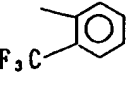
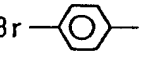
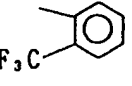
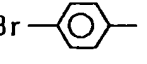
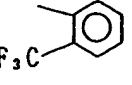
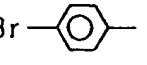
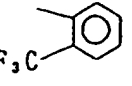
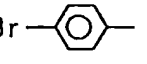
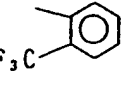
| Comp. No. | $(R_3)_m$  | R_1 |  $(R_2)_1$ | Physical Property (Melting point) |
|-----------|---|--|--|-----------------------------------|
| a-11 | Cl-  | $-\text{COC}(\text{CH}_3)_3$ |  | 87~92°C |
| a-12 | Cl-  | $-\text{SO}_2\text{CH}_3$ |  | 104~108°C |
| a-13 | Cl-  | $-\text{SO}_2\text{CH}_2\text{CH}_3$ |  | 109~112°C |
| a-14 | Cl-  | $-\text{SO}_2(\text{CH}_2)_2\text{CH}_3$ |  | 86~89°C |
| a-15 | Br-  | $-\text{COCH}_3$ |  | |
| a-16 | Br-  | $-\text{COCH}_2\text{CH}_3$ |  | |
| a-17 | Br-  | $-\text{CO}(\text{CH}_2)_2\text{CH}_3$ |  | |
| a-18 | Br-  | $-\text{COCH}(\text{CH}_3)_2$ |  | |
| a-19 | Br-  | $-\text{COC}(\text{CH}_3)_3$ |  | |
| a-20 | Br-  | $-\text{SO}_2\text{CH}_3$ |  | 105~112°C |
| a-21 | Br-  | $-\text{SO}_2\text{CH}_2\text{CH}_3$ |  | 131~132°C |
| a-22 | Br-  | $-\text{SO}_2(\text{CH}_2)_2\text{CH}_3$ |  | Oily |

Table I-a (Continued)

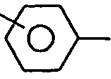


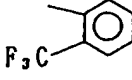

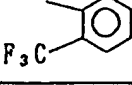

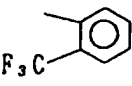

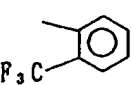

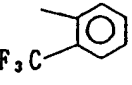

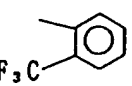

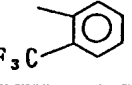

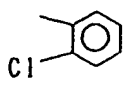

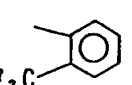

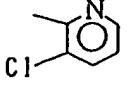

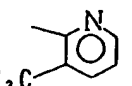

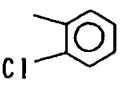
| Comp. No. | $(R_3)_m$  | R_1 |  $(R_2)_1$ | Physical Property (Melting point) |
|-----------|---|--|---|-----------------------------------|
| a-23 | Br-  | $-\text{SO}_2(\text{CH}_2)_3\text{CH}_3$ |  F_3C | Oily |
| a-24 | Cl-  Cl | $-\text{COSCH}_3$ |  F_3C | Oily |
| a-25 | Cl-  Cl | $-\text{COSCH}_2\text{CH}_3$ |  F_3C | Oily |
| a-26 | Cl-  Cl | $-\text{CH}_3$ |  F_3C | |
| a-27 | Cl-  Cl | $-\text{CH}_2\text{CH}_3$ |  F_3C | 133~ 135°C |
| a-28 | Cl-  Cl | $-\text{CH}_2\text{CF}_3$ |  F_3C | |
| a-29 | Cl-  Cl | $-\text{CH}_2\text{OCH}_3$ |  F_3C | E-isomer 99~ 103°C |
| a-30 | Cl-  Cl | $-\text{COCH}_3$ |  Cl | 138~ 140°C |
| a-31 | Cl-  Cl | $-\text{COCH}_3$ |  F_3C | 75~ 78°C |
| a-32 | Cl-  Cl | $-\text{COCH}_3$ |  Cl | |
| a-33 | Cl-  Cl | $-\text{COCH}_3$ |  F_3C | |
| a-34 | Cl-  Cl | $-\text{COCH}_2\text{CH}_3$ |  Cl | 93~ 94°C |

Table I-a (Continued)

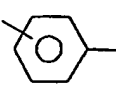

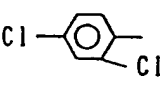
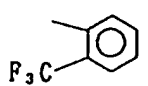
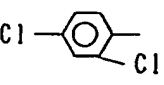
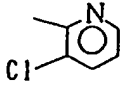
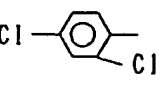
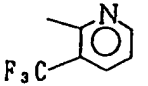
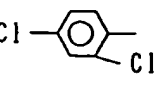
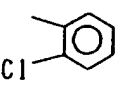
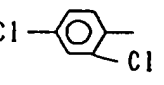
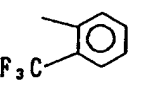
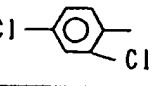
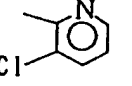
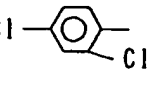
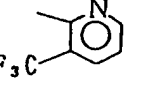
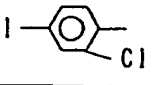
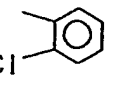
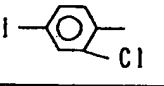
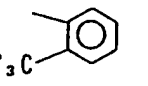
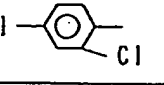
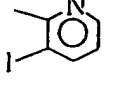
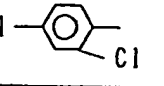
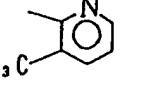
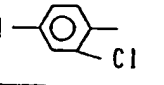
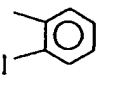
| Comp. No. | $(R_3)_m$  | R_1 |  $(R_2)_1$ | Physical Property (Melting point) |
|-----------|---|--|--|-----------------------------------|
| a-35 |  | $-\text{COCH}_2\text{CH}_3$ |  | |
| a-36 |  | $-\text{COCH}_2\text{CH}_3$ |  | |
| a-37 |  | $-\text{COCH}_2\text{CH}_3$ |  | |
| a-38 |  | $-\text{CO}(\text{CH}_2)_2\text{CH}_3$ |  | 59~60°C |
| a-39 |  | $-\text{CO}(\text{CH}_2)_2\text{CH}_3$ |  | Oily |
| a-40 |  | $-\text{CO}(\text{CH}_2)_2\text{CH}_3$ |  | |
| a-41 |  | $-\text{CO}(\text{CH}_2)_2\text{CH}_3$ |  | |
| a-42 |  | $-\text{COCH}(\text{CH}_3)_2$ |  | 92~94°C |
| a-43 |  | $-\text{COCH}(\text{CH}_3)_2$ |  | Oily |
| a-44 |  | $-\text{COCH}(\text{CH}_3)_2$ |  | |
| a-45 |  | $-\text{COCH}(\text{CH}_3)_2$ |  | |
| a-46 |  | $-\text{CO}(\text{CH}_2)_3\text{CH}_3$ |  | Oily |

Table I-a (Continued)

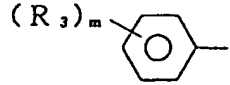
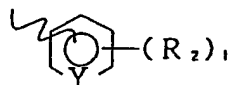
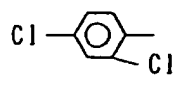
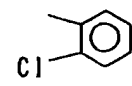
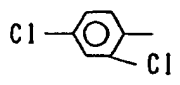
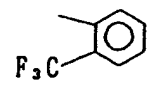
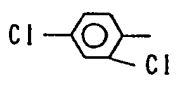
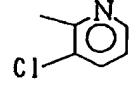
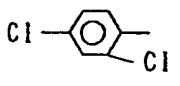
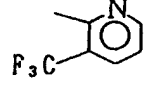
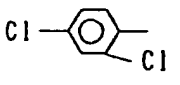
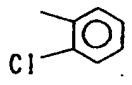
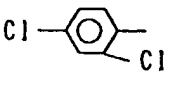
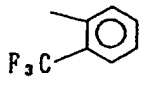
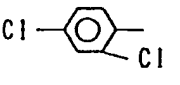
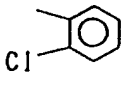
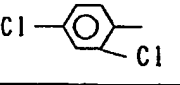
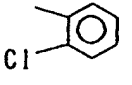
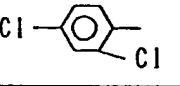
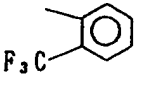
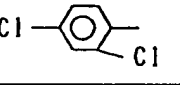
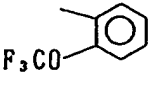
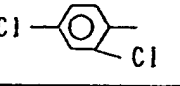
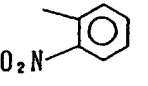
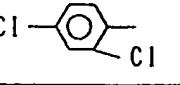
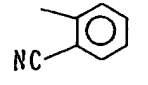
| Comp. No. | $(R_3)_m$  | R_1 |  $(R_2)_1$ | Physical Property (Melting point) |
|-----------|---|--------------------------------------|--|-----------------------------------|
| a-47 |  | $-\text{COC}(\text{CH}_3)_3$ |  | Oily |
| a-48 |  | $-\text{COC}(\text{CH}_3)_3$ |  | Oily |
| a-49 |  | $-\text{COC}(\text{CH}_3)_3$ |  | |
| a-50 |  | $-\text{COC}(\text{CH}_3)_3$ |  | |
| a-51 |  | $-\text{CO}(\text{CH}_2)_2\text{Cl}$ |  | |
| a-52 |  | $-\text{CO}(\text{CH}_2)_2\text{Cl}$ |  | |
| a-53 |  | $-\text{SO}_2\text{CH}_3$ |  | Z-isomer 121~ 123°C |
| a-54 |  | $-\text{SO}_2\text{CH}_3$ |  | E-isomer 115~ 117°C |
| a-55 |  | $-\text{SO}_2\text{CH}_3$ |  | Oily |
| a-56 |  | $-\text{SO}_2\text{CH}_3$ |  | |
| a-57 |  | $-\text{SO}_2\text{CH}_3$ |  | Amorphous |
| a-58 |  | $-\text{SO}_2\text{CH}_3$ |  | |

Table I-a (Continued)

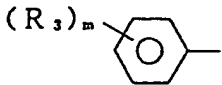
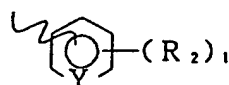
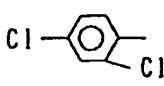
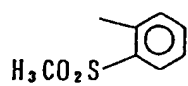
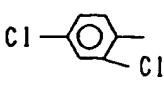
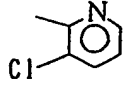
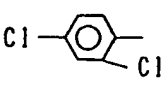
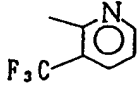
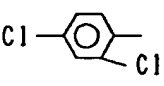
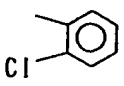
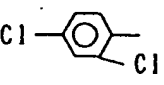
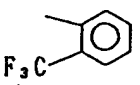
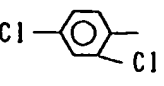
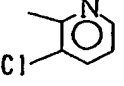
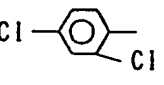
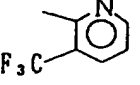
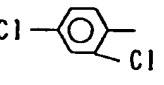
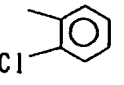
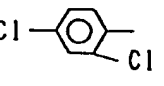
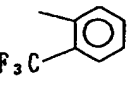
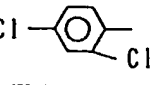
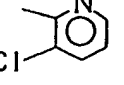
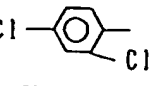
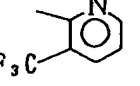
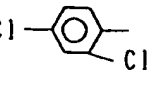
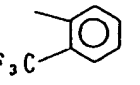
| Comp. No. | $(R_3)_m$  | R_1 |  $(R_2)_1$ | Physical Property (Melting point) |
|-----------|---|--|--|-----------------------------------|
| a-59 |  | $-\text{SO}_2\text{CH}_3$ |  | |
| a-60 |  | $-\text{SO}_2\text{CH}_3$ |  | |
| a-61 |  | $-\text{SO}_2\text{CH}_3$ |  | |
| a-62 |  | $-\text{SO}_2\text{CH}_2\text{CH}_3$ |  | |
| a-63 |  | $-\text{SO}_2\text{CH}_2\text{CH}_3$ |  | E-isomer 114~ 116°C |
| a-64 |  | $-\text{SO}_2\text{CH}_2\text{CH}_3$ |  | |
| a-65 |  | $-\text{SO}_2\text{CH}_2\text{CH}_3$ |  | |
| a-66 |  | $-\text{SO}_2(\text{CH}_2)_2\text{CH}_3$ |  | |
| a-67 |  | $-\text{SO}_2(\text{CH}_2)_2\text{CH}_3$ |  | E-isomer 95~ 96°C |
| a-68 |  | $-\text{SO}_2(\text{CH}_2)_2\text{CH}_3$ |  | |
| a-69 |  | $-\text{SO}_2(\text{CH}_2)_2\text{CH}_3$ |  | |
| a-70 |  | $-\text{SO}_2\text{CH}(\text{CH}_3)_2$ |  | 109~ 112°C |

Table I-a (Continued)

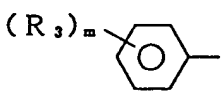
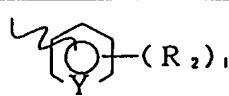
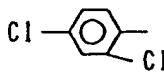
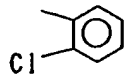
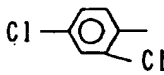
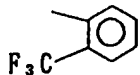
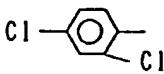
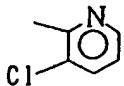
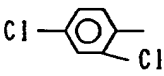
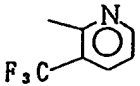
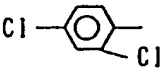
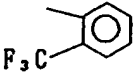
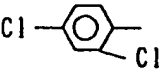
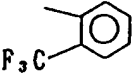
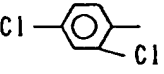
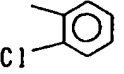
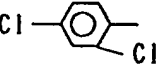
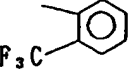
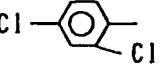
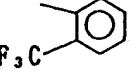
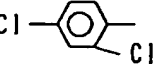
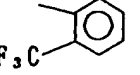
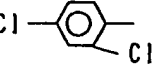
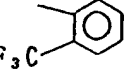
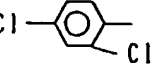
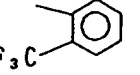
| Comp. No. | $(R_3)_m$  | R_1 |  $(R_2)_l$ | Physical Property (Melting point) |
|-----------|---|---|--|-----------------------------------|
| a-71 |  | $-\text{SO}_2(\text{CH}_2)_3\text{CH}_3$ |  | |
| a-72 |  | $-\text{SO}_2(\text{CH}_2)_3\text{CH}_3$ |  | Oily |
| a-73 |  | $-\text{SO}_2(\text{CH}_2)_3\text{CH}_3$ |  | |
| a-74 |  | $-\text{SO}_2(\text{CH}_2)_3\text{CH}_3$ |  | |
| a-75 |  | $-\text{SO}_2(\text{CH}_2)_4\text{CH}_3$ |  | |
| a-76 |  | $-\text{SO}_2(\text{CH}_2)_2\text{Cl}$ |  | |
| a-77 |  | $-\text{SO}_2\text{CF}_3$ |  | Oily |
| a-78 |  | $-\text{SO}_2\text{CF}_3$ |  | $n_D^{48.2}$ 1.5430 |
| a-79 |  | $-\text{SO}_2\text{CH}_2\text{CF}_3$ |  | |
| a-80 |  | $-\text{SO}_2\text{CH}=\text{CH}_2$ |  | 117~ 120°C |
| a-81 |  | $-\text{SO}_2\text{CH}_2\text{CH}=\text{CH}_2$ |  | |
| a-82 |  | $-\text{SO}_2-\text{C}_6\text{H}_4-\text{CH}_3$ |  | 165~ 167°C |

Table I-a (Continued)

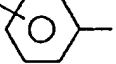

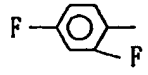
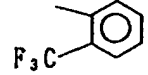
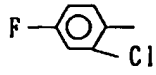
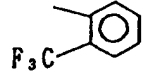
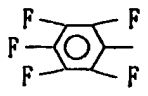
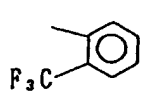
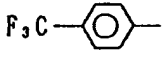
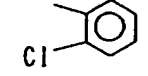
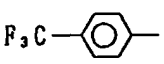
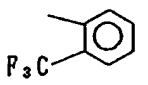
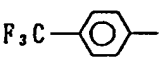
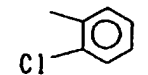
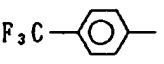
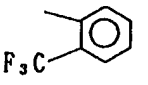
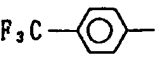
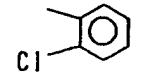
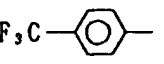
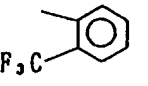
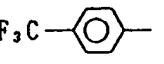
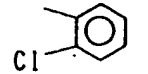
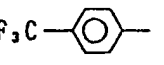
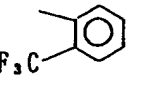
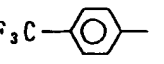
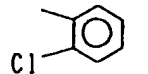
| Comp. No. | $(R_3)_m$  | R_1 |  $(R_2)_1$ | Physical Property (Melting point) |
|-----------|---|--|---|-----------------------------------|
| a-83 |  | $-\text{SO}_2\text{CH}_3$ |  | Oily |
| a-84 |  | $-\text{SO}_2\text{CH}_3$ |  | |
| a-85 |  | $-\text{SO}_2\text{CH}_3$ |  | |
| a-86 |  | $-\text{COCH}_3$ |  | |
| a-87 |  | $-\text{COCH}_3$ |  | |
| a-88 |  | $-\text{COCH}_2\text{CH}_3$ |  | |
| a-89 |  | $-\text{COCH}_2\text{CH}_3$ |  | |
| a-90 |  | $-\text{CO}(\text{CH}_2)_2\text{CH}_3$ |  | |
| a-91 |  | $-\text{CO}(\text{CH}_2)_2\text{CH}_3$ |  | |
| a-92 |  | $-\text{COCH}(\text{CH}_3)_2$ |  | |
| a-93 |  | $-\text{COCH}(\text{CH}_3)_2$ |  | |
| a-94 |  | $-\text{COC}(\text{CH}_3)_3$ |  | |

Table I-a (Continued)

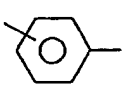

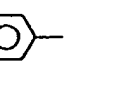
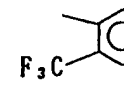
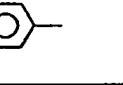
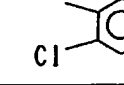
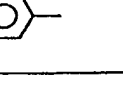
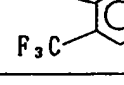
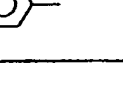
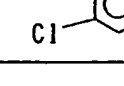
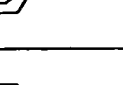
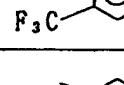
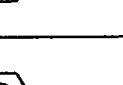
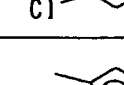
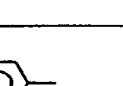
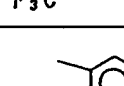
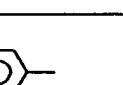
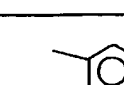
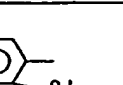
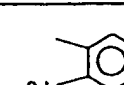
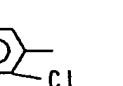
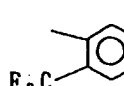
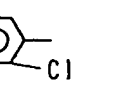
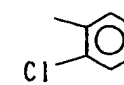
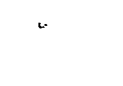

| Comp. No. | $(R_3)_m$  | R_1 |  $(R_2)_1$ | Physical Property (Melting point) |
|-----------|---|---------------------|--|-----------------------------------|
| a-95 | F_3C  | $-COC(CH_3)_3$ | F_3C  | |
| a-96 | F_3C  | $-SO_2CH_3$ | Cl  | 121~124°C |
| a-97 | F_3C  | $-SO_2CH_3$ | F_3C  | 115~125°C |
| a-98 | F_3C  | $-SO_2CH_2CH_3$ | Cl  | |
| a-99 | F_3C  | $-SO_2CH_2CH_3$ | F_3C  | 68~71°C |
| a-100 | F_3C  | $-SO_2(CH_2)_2CH_3$ | Cl  | |
| a-101 | F_3C  | $-SO_2(CH_2)_2CH_3$ | F_3C  | |
| a-102 | F_3C  | $-SO_2(CH_2)_3CH_3$ | Cl  | |
| a-103 | F_3C  | $-SO_2(CH_2)_3CH_3$ | F_3C  | |
| a-104 | F_3C  Cl | $-COCH_3$ | Cl  | |
| a-105 | F_3C  Cl | $-COCH_3$ | F_3C  | |
| a-106 | F_3C  Cl | $-COCH_2CH_3$ | Cl  | |

Table I-a (Continued)

| Comp. No. | $(R_3)_m$ | R_1 | $(R_2)_1$ | Physical Property (Melting point) |
|-----------|-----------|--|-----------|-----------------------------------|
| a-107 | | $-\text{COCH}_2\text{CH}_3$ | | |
| a-108 | | $-\text{CO}(\text{CH}_2)_2\text{CH}_3$ | | |
| a-109 | | $-\text{CO}(\text{CH}_2)_2\text{CH}_3$ | | |
| a-110 | | $-\text{COCH}(\text{CH}_3)_2$ | | |
| a-111 | | $-\text{COCH}(\text{CH}_3)_2$ | | |
| a-112 | | $-\text{COC}(\text{CH}_3)_3$ | | |
| a-113 | | $-\text{COC}(\text{CH}_3)_3$ | | |
| a-114 | | $-\text{SO}_2\text{CH}_3$ | | |
| a-115 | | $-\text{SO}_2\text{CH}_3$ | | |
| a-116 | | $-\text{SO}_2\text{CH}_2\text{CH}_3$ | | |
| a-117 | | $-\text{SO}_2\text{CH}_2\text{CH}_3$ | | |
| a-118 | | $-\text{SO}_2(\text{CH}_2)_2\text{CH}_3$ | | |

Table I-a (Continued)

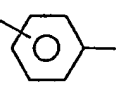

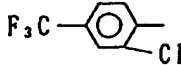
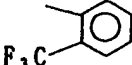
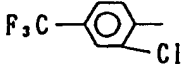
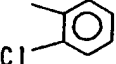
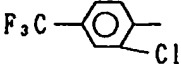
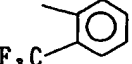
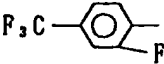
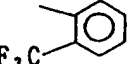
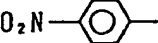
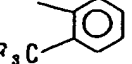
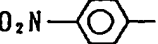
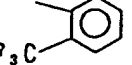
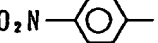
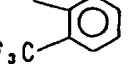
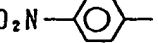
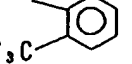
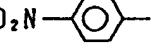
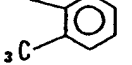
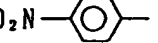
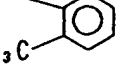
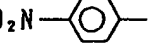
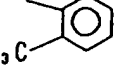
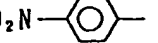
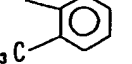
| Comp. No. | $(R_3)_m$  | R_1 |  $(R_2)_1$ | Physical Property (Melting point) |
|-----------|---|--|--|-----------------------------------|
| a-119 |  | $-\text{SO}_2(\text{CH}_2)_2\text{CH}_3$ |  | |
| a-120 |  | $-\text{SO}_2(\text{CH}_2)_3\text{CH}_3$ |  | |
| a-121 |  | $-\text{SO}_2(\text{CH}_2)_3\text{CH}_3$ |  | |
| a-122 |  | $-\text{SO}_2\text{CH}_3$ |  | |
| a-123 |  | $-\text{COCH}_3$ |  | 92~95°C |
| a-124 |  | $-\text{COCH}_2\text{CH}_3$ |  | |
| a-125 |  | $-\text{CO}(\text{CH}_2)_2\text{CH}_3$ |  | |
| a-126 |  | $-\text{COCH}(\text{CH}_3)_2$ |  | |
| a-127 |  | $-\text{COC}(\text{CH}_3)_3$ |  | |
| a-128 |  | $-\text{SO}_2\text{CH}_3$ |  | 125~128°C |
| a-129 |  | $-\text{SO}_2\text{CH}_2\text{CH}_3$ |  | |
| a-130 |  | $-\text{SO}_2(\text{CH}_2)_2\text{CH}_3$ |  | |

Table I-a (Continued)

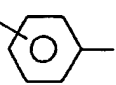

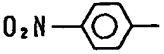
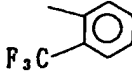
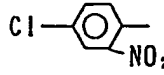
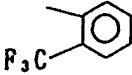
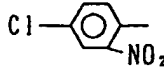
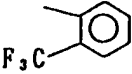
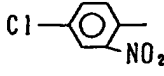
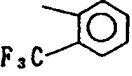
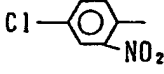
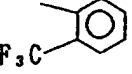
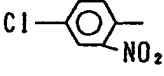
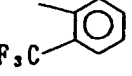
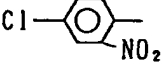
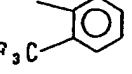
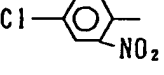
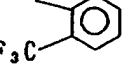
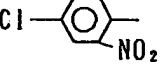
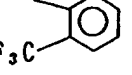
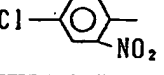
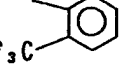
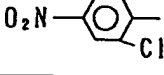
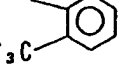
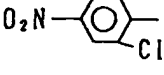
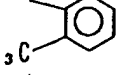
| Comp. No. | $(R_3)_m$  | R_1 |  $(R_2)_1$ | Physical Property (Melting point) |
|-----------|---|--|--|-----------------------------------|
| a-131 |  | $-\text{SO}_2(\text{CH}_2)_3\text{CH}_3$ |  | |
| a-132 |  | $-\text{COCH}_3$ |  | |
| a-133 |  | $-\text{COCH}_2\text{CH}_3$ |  | |
| a-134 |  | $-\text{CO}(\text{CH}_2)_2\text{CH}_3$ |  | |
| a-135 |  | $-\text{COCH}(\text{CH}_3)_2$ |  | |
| a-136 |  | $-\text{COC}(\text{CH}_3)_3$ |  | |
| a-137 |  | $-\text{SO}_2\text{CH}_3$ |  | 130~133°C |
| a-138 |  | $-\text{SO}_2\text{CH}_2\text{CH}_3$ |  | |
| a-139 |  | $-\text{SO}_2(\text{CH}_2)_2\text{CH}_3$ |  | |
| a-140 |  | $-\text{SO}_2(\text{CH}_2)_3\text{CH}_3$ |  | |
| a-141 |  | $-\text{COCH}_3$ |  | |
| a-142 |  | $-\text{COCH}_2\text{CH}_3$ |  | |

Table I-a (Continued)

| Comp. No. | $(R_3)_m$ | R_1 | $(R_2)_1$ | Physical Property (Melting point) |
|-----------|-----------|--|-----------|-----------------------------------|
| a-143 | | $-\text{CO}(\text{CH}_2)_2\text{CH}_3$ | | |
| a-144 | | $-\text{COCH}(\text{CH}_3)_2$ | | |
| a-145 | | $-\text{COC}(\text{CH}_3)_3$ | | |
| a-146 | | $-\text{SO}_2\text{CH}_3$ | | |
| a-147 | | $-\text{SO}_2\text{CH}_2\text{CH}_3$ | | |
| a-148 | | $-\text{SO}_2(\text{CH}_2)_2\text{CH}_3$ | | |
| a-149 | | $-\text{SO}_2(\text{CH}_2)_3\text{CH}_3$ | | |
| a-150 | | $-\text{COC}(\text{CH}_3)_3$ | | $n_D^{30.8}$ 1.5432 |
| a-151 | | $-\text{SO}_2\text{CH}_3$ | | 147.3 °C |
| a-152 | | $-\text{COC}(\text{CH}_3)_3$ | | $n_D^{30.8}$ 1.5336 |
| a-153 | | $-\text{COCH}_3$ | | Oily |
| a-154 | | $-\text{SO}_2\text{N}(\text{CH}_3)_2$ | | |

Table I-a (Continued)

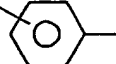

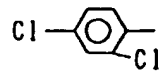

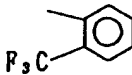
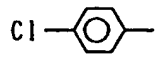
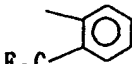
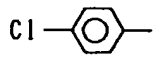
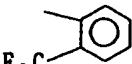
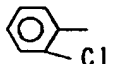
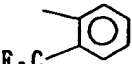

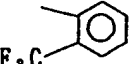
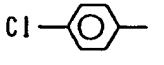
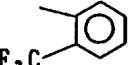
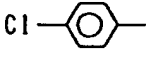
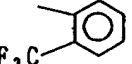
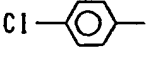
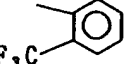
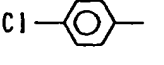
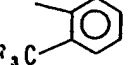
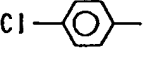
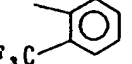
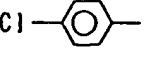
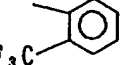
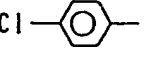
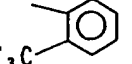
| Comp. No. | $(R_3)_m$  | R_1 |  $(R_2)_1$ | Physical Property (Melting point) |
|-----------|---|---|--|-----------------------------------|
| a-155 |  | $-\text{CO}-$  |  | |
| a-156 |  | $-\text{SO}_2(\text{CH}_2)_3\text{CH}_3$ |  | 63~ 64°C |
| a-157 |  | $-\text{CS}_2\text{C}\equiv\text{CH}$ |  | |
| a-158 |  | $-\text{SO}_2\text{CH}_3$ |  | 90~ 93°C |
| a-159 |  | $-\text{SO}_2\text{CH}_3$ |  | Oily |
| a-160 |  | $-\text{COCH}_3$ |  | 77~ 80°C |
| a-161 |  | $-\text{COCH}_2\text{CH}_3$ |  | 65~ 69°C |
| a-162 |  | $-\text{COCH}(\text{CH}_3)_2$ |  | 83~ 84°C |
| a-163 |  | $-\text{SO}_2(\text{CH}_2)_4\text{CH}_3$ |  | Oily |
| a-164 |  | $-\text{SO}_2\text{CH}=\text{CH}_2$ |  | 73~ 76°C |
| a-165 |  | $-\text{SO}_2\text{CF}_3$ |  | Oily |
| a-166 |  | $-\text{SO}_2\text{CH}_2\text{CF}_3$ |  | 102~ 105°C |

Table I-a (Continued)

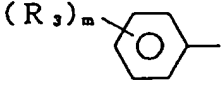
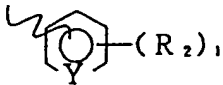

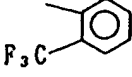

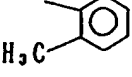



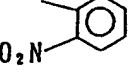

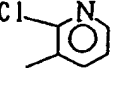

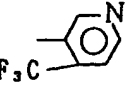

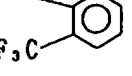

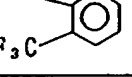

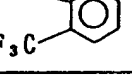

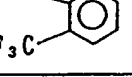

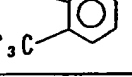

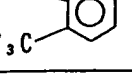
| Comp. No. | $(R_3)_m$  | R_1 |  $(R_2)_1$ | Physical Property (Melting point) |
|-----------|---|---|--|-----------------------------------|
| a-167 | Cl-  | $-\text{SO}_2(\text{CH}_2)_3\text{Cl}$ |  | Oily |
| a-168 | Cl-  | $-\text{SO}_2\text{CH}_3$ |  | 95~100°C |
| a-169 | Cl-  | $-\text{SO}_2\text{CH}_3$ |  | 121~123°C |
| a-170 | Cl-  | $-\text{SO}_2\text{CH}_3$ |  | Oily |
| a-171 | Cl-  | $-\text{SO}_2\text{CH}_3$ |  | $n_D^{23.8}$ 1.5991 |
| a-172 | Cl-  | $-\text{SO}_2\text{CH}_3$ |  | 101.9 °C |
| a-173 | F-  | $-\text{SO}_2\text{N}(\text{CH}_3)\text{CH}_2\text{CH}_3$ |  | 77~79°C |
| a-174 | F-  | $-\text{COCH}_3$ |  | |
| a-175 | F-  | $-\text{SO}_2\text{CH}_3$ |  | 95~98°C |
| a-176 | F-  | $-\text{SO}_2\text{CH}_2\text{CH}_3$ |  | 99~102°C |
| a-177 | F-  | $-\text{SO}_2(\text{CH}_2)_2\text{CH}_3$ |  | 101~102°C |
| a-178 | F-  | $-\text{SO}_2(\text{CH}_2)_3\text{CH}_3$ |  | 83~85°C |

Table I-a (Continued)

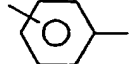


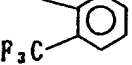

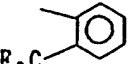

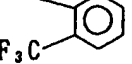

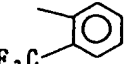

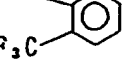

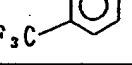

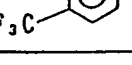

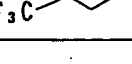
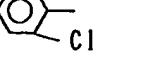
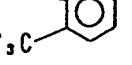
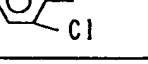
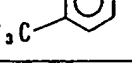
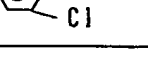
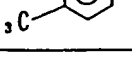
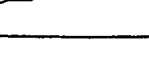
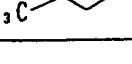
| Comp. No. | $(R_3)_m$  | R_1 |  $(R_2)_1$ | Physical Property (Melting point) |
|-----------|---|--|---|-----------------------------------|
| a-179 | Br-  | -COSCH ₃ |  | Oily |
| a-180 | Br-  | -SO ₂ (CH ₂) ₄ CH ₃ |  | Oily |
| a-181 | Br-  | -COSCH ₂ CH ₃ |  | 65~ 68°C |
| a-182 | I-  | -COCH ₃ |  | |
| a-183 | I-  | -SO ₂ CH ₃ |  | 112~ 113°C |
| a-184 | I-  | -SO ₂ CH ₂ CH ₃ |  | 126~ 128°C |
| a-185 | I-  | -SO ₂ (CH ₂) ₂ CH ₃ |  | 106~ 107°C |
| a-186 | I-  | -SO ₂ (CH ₂) ₃ CH ₃ |  | 73~ 75°C |
| a-187 | Cl-  | -SO ₂ (CH ₂) ₃ Cl |  | Oily |
| a-188 | Cl-  | -SO ₂ (CH ₂) ₂ CH ₃ |  | Z-isomer 75~ 77°C |
| a-189 | Cl-  | -SO ₂ CH ₂ CH ₃ |  | Z-isomer Oily |
| a-190 | Cl-  | -SO ₂ CH ₃ |  | 96~ 98°C |

Table I-a (Continued)

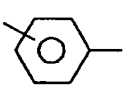

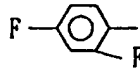
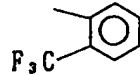
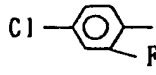
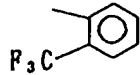
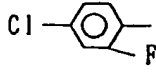
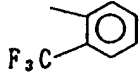
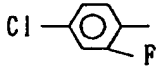
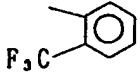
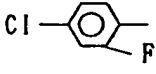
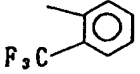
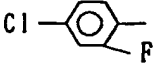
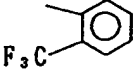
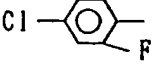
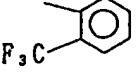
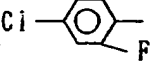
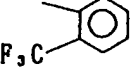
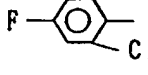
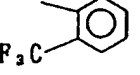
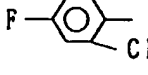
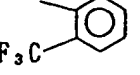
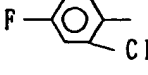
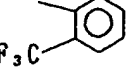
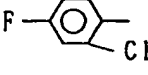
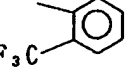
| Comp. No. | $(R_3)_m$  | R_1 |  $(R_2)_1$ | Physical Property (Melting point) |
|-----------|---|--|--|-----------------------------------|
| a-191 |  | $-\text{SO}_2\text{CH}_2\text{CH}_3$ |  | 84.2 °C |
| a-192 |  | $-\text{SO}_2\text{N}(\text{CH}_3)\text{CH}_2\text{CH}_3$ |  | |
| a-193 |  | $-\text{COCH}_3$ |  | |
| a-194 |  | $-\text{SO}_2\text{CH}_3$ |  | 81~ 84°C |
| a-195 |  | $-\text{SO}_2\text{CH}_2\text{CH}_3$ |  | 122~ 125°C |
| a-196 |  | $-\text{SO}_2(\text{CH}_2)_2\text{CH}_3$ |  | 65~ 66°C |
| a-197 |  | $-\text{SO}_2(\text{CH}_2)_3\text{CH}_3$ |  | Oily |
| a-198 |  | $-\text{SO}_2\text{N}(\text{CH}_2)_2\text{CH}_3$ CH_3 |  | |
| a-199 |  | $-\text{COCH}_3$ |  | |
| a-200 |  | $-\text{SO}_2\text{CH}_2\text{CH}_3$ |  | 103~ 105°C |
| a-201 |  | $-\text{SO}_2(\text{CH}_2)_2\text{CH}_3$ |  | 80~ 82°C |
| a-202 |  | $-\text{SO}_2(\text{CH}_2)_3\text{CH}_3$ |  | 50~ 52°C |

Table I-a (Continued)

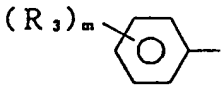

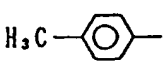
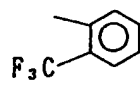
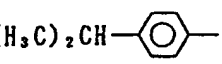
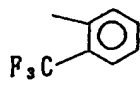
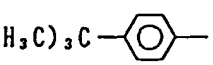
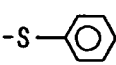
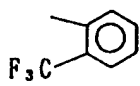
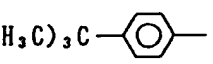
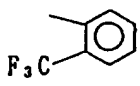
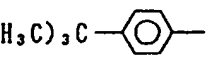
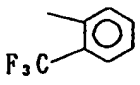
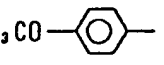
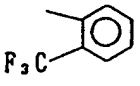
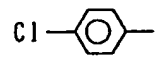
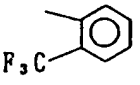
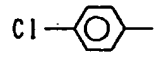
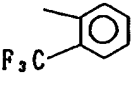
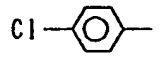
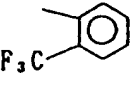
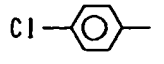
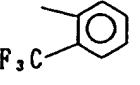
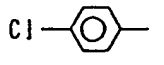
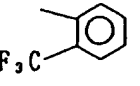
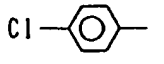
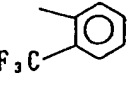
| Comp. No. | $(R_3)_m$  | R_1 |  $(R_2)_1$ | Physical Property (Melting point) |
|-----------|--|--|---|-----------------------------------|
| a-203 | H_3C  | $-SO_2CH_3$ |  | 133~ 136°C |
| a-204 | $(H_3C)_2CH$  | $-SO_2CH_3$ |  | 88~ 91°C |
| a-205 | $(H_3C)_3C$  | $-S$  |  | |
| a-206 | $(H_3C)_3C$  | $-SO_2CH_3$ |  | 101~ 103°C |
| a-207 | $(H_3C)_3C$  | $-SO_2(CH_2)_2CH_3$ |  | 68~ 70°C |
| a-208 | H_3CO  | $-SO_2CH_3$ |  | 127~ 130°C |
| a-209 | Cl  | $-CH_2CH_3$ |  | 105~ 107°C |
| a-210 | Cl  | $-CH_2CH_2Cl$ |  | 71~ 73°C |
| a-211 | Cl  | $-CH_2OCH_3$ |  | 68~ 72°C |
| a-212 | Cl  | $-CH_2OCH_2CH_3$ |  | oily |
| a-213 | Cl  | $-CH_2CH_2OCH_3$ |  | |
| a-214 | Cl  | $-SO_2CH(CH_3)_2$ |  | 82~ 84°C |

Table I-a (Continued)




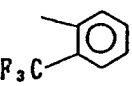

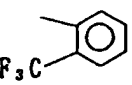

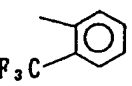

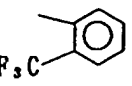

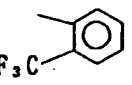

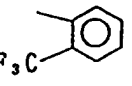

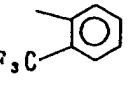
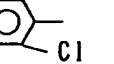
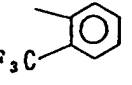
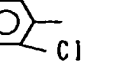
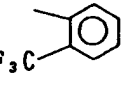
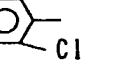
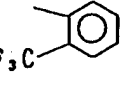
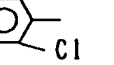
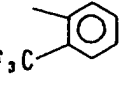
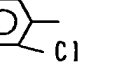
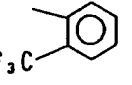
| Comp. No. | $(R_3)_m$  | R_1 |  $(R_2)_1$ | Physical Property (Melting point) |
|-----------|---|--|---|-----------------------------------|
| a-215 | Cl-  | $-\text{SO}_2\text{CH}_2\text{CH}(\text{CH}_3)_2$ |  | 80~ 83°C |
| a-216 | Cl-  | $-\text{SO}_2\text{CH}(\text{CH}_3)\text{CH}_2\text{CH}_3$ |  | |
| a-217 | Cl-  | $-\text{SO}_2\text{C}(\text{CH}_3)_3$ |  | |
| a-218 | Cl-  | $-\text{SO}_2\text{N}(\text{CH}_3)_2$ |  | 110~ 112°C |
| a-219 | F-  | $-\text{SO}_2\text{N}(\text{CH}_3)_2$ |  | 84~ 86°C |
| a-220 | Br-  | $-\text{SO}_2\text{N}(\text{CH}_3)_2$ |  | 120~ 121°C |
| a-221 | I-  | $-\text{SO}_2\text{N}(\text{CH}_3)_2$ |  | 126~ 127°C |
| a-222 | Cl-  | $-\text{CH}_2\text{CH}_2\text{Cl}$ |  | 88~ 90°C |
| a-223 | Cl-  | $-\text{CH}_2\text{OCH}_2\text{CH}_3$ |  | E-isomer 86~ 88°C |
| a-224 | Cl-  | $-\text{CH}_2\text{OCH}_2\text{CH}_3$ |  | Z-isomer 77~ 80°C |
| a-225 | Cl-  | $-\text{CH}_2\text{CH}_2\text{OCH}_3$ |  | 111~ 113°C |
| a-226 | Cl-  | $-\text{CH}_2\text{SCH}_3$ |  | E-isomer 87~ 92°C |

Table I-a (Continued)

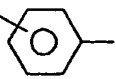

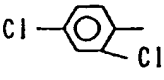
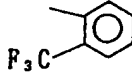
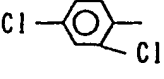
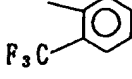
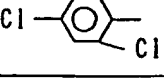
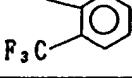
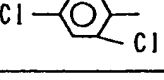
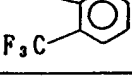
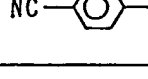
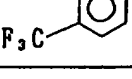

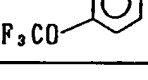
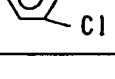
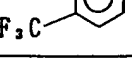
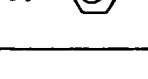
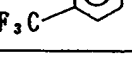
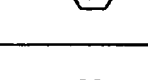
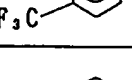
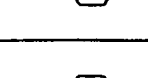
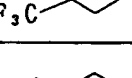
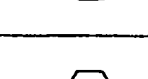
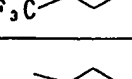
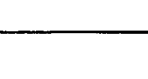
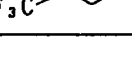
| Comp. No. | $(R_3)_n$  | R_1 |  $(R_2)_1$ | Physical Property (Melting point) |
|-----------|---|--|--|-----------------------------------|
| a-227 |  | $-\text{SO}_2\text{CH}_2\text{CH}(\text{CH}_3)_2$ |  | Oily |
| a-228 |  | $-\text{SO}_2\text{CH}(\text{CH}_3)\text{CH}_2\text{CH}_3$ |  | |
| a-229 |  | $-\text{SO}_2\text{C}(\text{CH}_3)_3$ |  | |
| a-230 |  | $-\text{SO}_2\text{N}(\text{CH}_3)_2$ |  | 137~141°C |
| a-231 |  | $-\text{SO}_2(\text{CH}_2)_2\text{CH}_3$ |  | 113.1 °C |
| a-232 |  | $-\text{SO}_2\text{CH}_3$ |  | 95.3 °C |
| a-233 |  | $-\text{SO}_2\text{CH}_2\text{CH}_3$ |  | Oily |
| a-234 |  | $-\text{CH}_3$ |  | 100~101°C |
| a-235 |  | $-(\text{CH}_2)_2\text{CH}_3$ |  | Oily |
| a-236 |  | $-\text{CH}(\text{CH}_3)_2$ |  | 81~82°C |
| a-237 |  | $-(\text{CH}_2)_3\text{CH}_3$ |  | Oily |
| a-238 |  | $-\text{CH}_2\text{CH}_2\text{F}$ |  | Oily |

Table I-a (Continued)

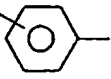

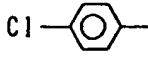
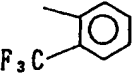
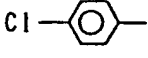
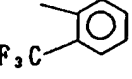
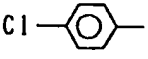
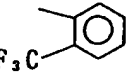
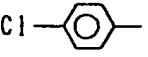
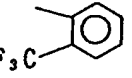
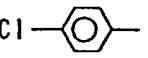
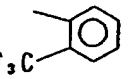
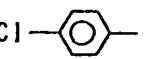
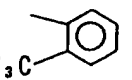
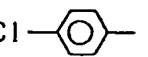
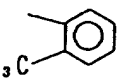
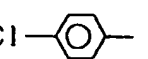
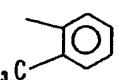
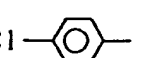
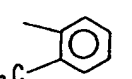
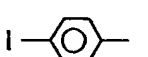
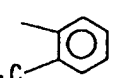
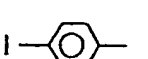
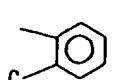
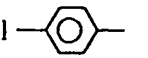
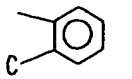
| Comp. No. | $(R_3)_m$  | R_1 |  $(R_2)_1$ | Physical Property (Melting point) |
|-----------|---|---|---|-----------------------------------|
| a-239 |  | $-\text{CH}_2\text{CF}_3$ |  | Oily |
| a-240 |  | $-\text{CH}_2\text{CH}=\text{CH}_2$ |  | Oily |
| a-241 |  | $-\text{CH}_2\text{C}(\text{Cl})=\text{CH}_2$ |  | |
| a-242 |  | $-\text{CH}_2\text{C}(\text{Cl})=\text{CHCl}$ |  | |
| a-243 |  | $-\text{CH}_2\text{C}\equiv\text{CH}$ |  | |
| a-244 |  | $-\text{COCH}_2\text{OCH}_3$ |  | Oily |
| a-245 |  | $-\text{COSCH}_2\text{CH}_3$ |  | Oily |
| a-246 |  | $-\text{COCH}_2\text{CH}=\text{CH}_2$ |  | |
| a-247 |  | $-\text{COCH}_2\text{C}(\text{Cl})=\text{CH}_2$ |  | |
| a-248 |  | $-\text{COCH}_2\text{C}\equiv\text{CH}$ |  | |
| a-249 |  | $-\text{COCH}_2\text{C}\equiv\text{CCl}$ |  | |
| a-250 |  | $-\text{CO}_2\text{CH}_3$ |  | 60~63°C |

Table I-a (Continued)

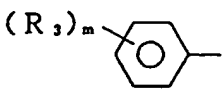
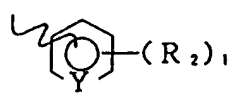
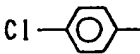
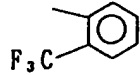
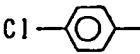
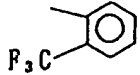
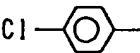
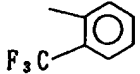
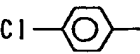
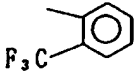
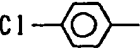
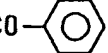
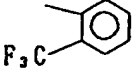
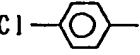
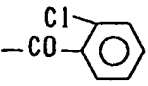
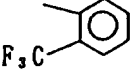
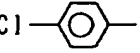
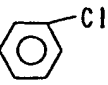
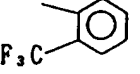
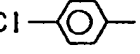

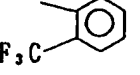
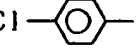
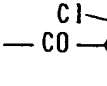
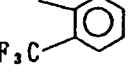
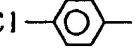
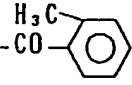
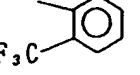
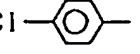

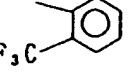
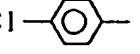

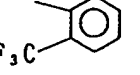
| Comp. No. | $(R_3)_m$  | R_1 |  $(R_2)_1$ | Physical Property (Melting point) |
|-----------|---|---|--|-----------------------------------|
| a-251 |  | $-\text{CO}_2\text{CH}_2\text{CH}_3$ |  | Oily |
| a-252 |  | $-\text{CO}_2\text{CH}_2\text{CF}_3$ |  | |
| a-253 |  | $-\text{CONH}(\text{CH}_2)_2\text{CH}_3$ |  | |
| a-254 |  | $-\text{CON}(\text{CH}_3)_2$ |  | 58~61°C |
| a-255 |  | $-\text{CO}-$  |  | 135~138°C |
| a-256 |  |  $-\text{CO}-$ |  | 109~111°C |
| a-257 |  | $-\text{CO}-$  |  | Oily |
| a-258 |  | $-\text{CO}-$  $-\text{Cl}$ |  | 106~109°C |
| a-259 |  |  $-\text{CO}-$ $-\text{Cl}$ |  | |
| a-260 |  |  $-\text{CO}-$ |  | 123~124°C |
| a-261 |  | $-\text{CO}-$  $-\text{CH}_3$ |  | 124~127°C |
| a-262 |  | $-\text{CO}-$  $-\text{OCH}_3$ |  | 110~113°C |

Table I-a (Continued)

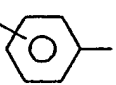



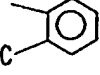

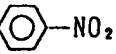
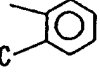

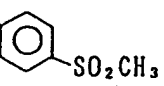
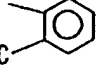


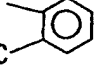


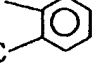

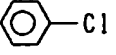
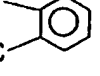

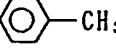
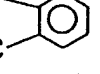


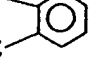


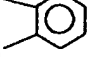


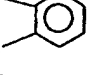


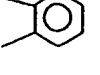

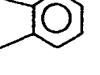
| Comp. No. | $(R_3)_m$  | R_1 |  $(R_2)_1$ | Physical Property (Melting point) |
|-----------|---|---|---|-----------------------------------|
| a-263 | Cl-  | -CO ₂ -  |  | Oily |
| a-264 | Cl-  | -CO ₂ -  |  | |
| a-265 | Cl-  | -CO ₂ -  |  | |
| a-266 | Cl-  | -COS-  |  | |
| a-267 | Cl-  | -COCH ₂ -  |  | 85~ 87°C |
| a-268 | Cl-  | -COCH ₂ -  |  | |
| a-269 | Cl-  | -COCH ₂ -  |  | |
| a-270 | Cl-  | -COSCH ₂ -  |  | |
| a-271 | Cl-  | -CON  |  | |
| a-272 | Cl-  | -CON  |  | |
| a-273 | Cl-  | -CON  |  | |
| a-274 | Cl-  | -SCH ₃ |  | Oily |

Table I-a (Continued)

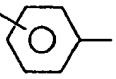

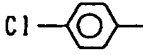
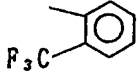
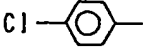
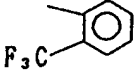
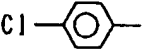
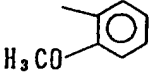
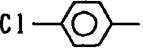
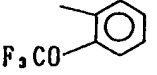
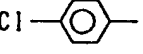
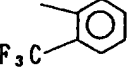
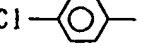
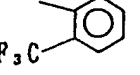
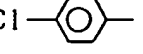
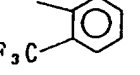
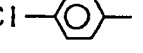
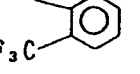
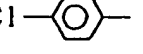
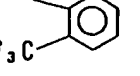
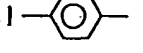
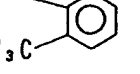
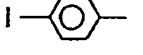
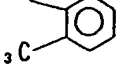
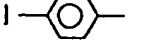
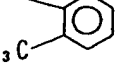
| Comp. No. | $(R_3)_m$  | R_1 |  $(R_2)_1$ | Physical Property (Melting point) |
|-----------|---|--|--|-----------------------------------|
| a-275 |  | $-\text{SOCH}_3$ |  | |
| a-276 |  | $-\text{SOCH}_2\text{CH}_3$ |  | |
| a-277 |  | $-\text{SO}_2\text{CH}_3$ |  | 153.9 °C |
| a-278 |  | $-\text{SO}_2\text{CH}_3$ |  | Oily |
| a-279 |  | $-\text{SO}_2\text{CH}_2\text{OCH}_3$ |  | |
| a-280 |  | $-\text{SO}_2\text{CH}_2\text{C}(\text{Cl})=\text{CH}_2$ |  | |
| a-281 |  | $-\text{SO}_2\text{CH}_2\text{C}\equiv\text{CCl}$ |  | |
| a-282 |  | $-\text{SO}_2\text{OCH}_2\text{CH}_3$ |  | 98~101°C |
| a-283 |  | $-\text{SO}_2\text{SCH}_2\text{CH}_3$ |  | |
| a-284 |  | $-\text{SO}_2\text{NH}(\text{CH}_2)_2\text{CH}_3$ |  | |
| a-285 |  | $-\text{SO}_2\text{NHC}(\text{CH}_3)_3$ |  | |
| a-286 |  | $-\text{SO}_2\text{N}(\text{CH}_2\text{CH}_3)_2$ |  | Oily |

Table I-a (Continued)

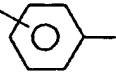

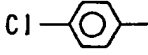
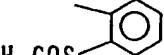
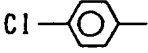
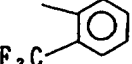
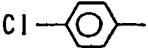
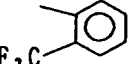
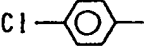

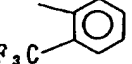
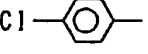

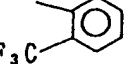
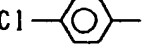

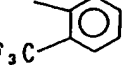
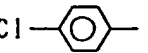

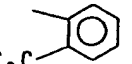
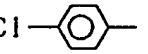

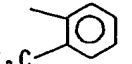
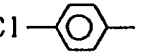

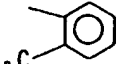
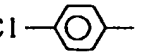

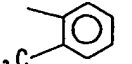
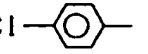
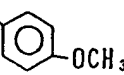
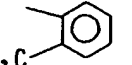
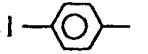

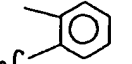
| Comp. No. | $(R_3)_m$  | R_1 |  $(R_2)_l$ | Physical Property (Melting point) |
|-----------|---|---|--|-----------------------------------|
| a-287 |  | $-\text{SO}_2\text{N}(\text{CH}_2\text{CH}_3)_2$ |  | |
| a-288 |  | $-\text{SO}_2\text{N}-(\text{CH}_2)_2\text{CH}_3$ $ $ $(\text{CH}_2)_2\text{CH}_3$ |  | Oily |
| a-289 |  | $-\text{SO}_2\text{N}-(\text{CH}_2)_3\text{CH}_3$ $ $ $(\text{CH}_2)_3\text{CH}_3$ |  | |
| a-290 |  | $-\text{SO}_2$  |  | 151~ 155°C |
| a-291 |  | $-\text{SO}_2$  $-\text{CH}_3$ |  | 152~ 156°C |
| a-292 |  | $-\text{SO}_2\text{O}$  |  | |
| a-293 |  | $-\text{SO}_2\text{O}$  $-\text{CH}_3$ |  | |
| a-294 |  | $-\text{SO}_2\text{S}$  |  | |
| a-295 |  | $-\text{SO}_2\text{CH}_2$  |  | |
| a-296 |  | $-\text{SO}_2\text{CH}_2$  $-\text{F}$ |  | |
| a-297 |  | $-\text{SO}_2\text{CH}_2$  $-\text{OCH}_3$ |  | |
| a-298 |  | $-\text{SO}_2\text{N}$  |  | 164~ 167°C |

Table I-a (Continued)

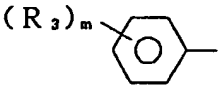
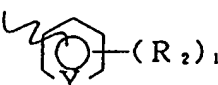
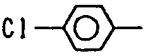
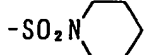
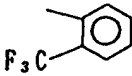
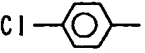
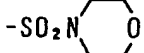
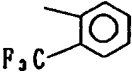
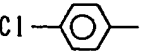
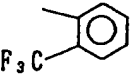
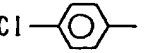
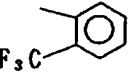
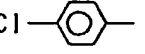
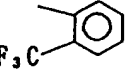
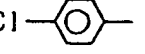
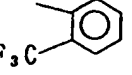
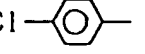
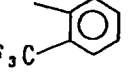

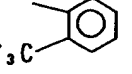
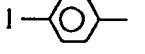
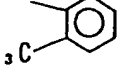

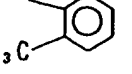
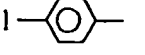
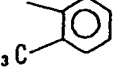
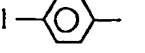
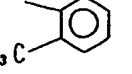
| Comp. No. | $(R_3)_m$  | R_1 |  $(R_2)_1$ | Physical Property (Melting point) |
|-----------|---|--|--|-----------------------------------|
| a-299 |  | $-\text{SO}_2\text{N}$  |  | Oily |
| a-300 |  | $-\text{SO}_2\text{N}$  |  | 80~82°C |
| a-301 |  | $-\text{CSCH}_3$ |  | |
| a-302 |  | $-\text{CSCH}_2\text{CH}_3$ |  | |
| a-303 |  | $-\text{CSOCH}_3$ |  | Oily |
| a-304 |  | $-\text{CSOCH}_2\text{CH}_3$ |  | Oily |
| a-305 |  | $-\text{CS}_2\text{CH}_3$ |  | $n_D^{39.4}$ 1.5930 |
| a-306 |  | $-\text{CS}_2\text{CH}_2\text{CH}_3$ |  | $n_D^{27.2}$ 1.5612 |
| a-307 |  | $-\text{CS}_2\text{CH}(\text{CH}_3)_2$ |  | $n_D^{33.8}$ 1.5824 |
| a-308 |  | $-\text{CS}_2(\text{CH}_2)_3\text{CH}_3$ |  | 80.3 °C |
| a-309 |  | $-\text{CS}_2\text{CH}_2\text{CF}_3$ |  | |
| a-310 |  | $-\text{CS}_2\text{CH}_2\text{CH}=\text{CH}_2$ |  | $n_D^{26.8}$ 1.6040 |

Table I-a (Continued)

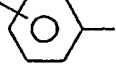


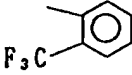

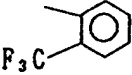

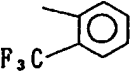


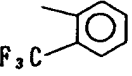

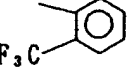

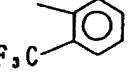

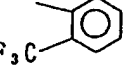


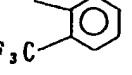


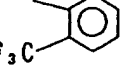

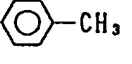
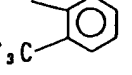

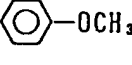
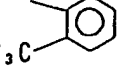


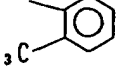
| Comp. No. | $(R_3)_m$  | R_1 |  $(R_2)_1$ | Physical Property (Melting point) |
|-----------|---|---|---|-----------------------------------|
| a-311 | Cl-  | $-\text{CS}_2\text{CH}_2\text{CH}=\text{CCl}_2$ |  | |
| a-312 | Cl-  | $-\text{CS}_2\text{CH}_2\text{C}\equiv\text{CH}$ |  | |
| a-313 | Cl-  | $-\text{CS}_2\text{CH}_2\text{C}\equiv\text{Cl}$ |  | |
| a-314 | Cl-  | $-\text{CS}_2$ -  |  | |
| a-315 | Cl-  | $-\text{CSNHC}(\text{CH}_3)_3$ |  | |
| a-316 | Cl-  | $-\text{CSN}(\text{CH}_3)_2$ |  | 137.9 °C |
| a-317 | Cl-  | $-\text{CSN}(\text{CH}_2\text{CH}_3)_2$ |  | 121~123°C |
| a-318 | Cl-  | $-\text{CS}$ -  |  | Oily |
| a-319 | Cl-  | $-\text{CSO}$ -  |  | Oily |
| a-320 | Cl-  | $-\text{CSO}$ -  -CH ₃ |  | |
| a-321 | Cl-  | $-\text{CSO}$ -  -OCH ₃ |  | |
| a-322 | Cl-  | $-\text{CS}_2$ -  |  | 113.8 °C |

Table I-a (Continued)

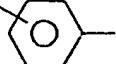

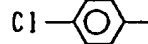
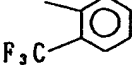
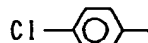
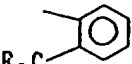
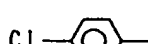
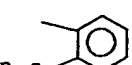
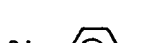
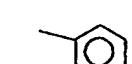
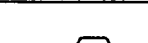
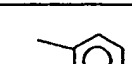
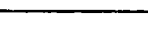

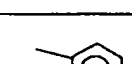


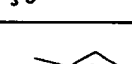
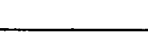
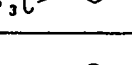

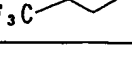
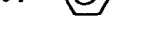
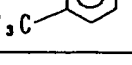

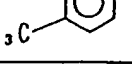
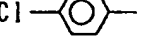
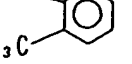
| Comp. No. | $(R_3)_m$  | R_1 |  $(R_2)_1$ | Physical Property (Melting point) |
|-----------|---|---|---|-----------------------------------|
| a-323 |  | $-\text{CS}_2-\text{C}_6\text{H}_4-\text{Cl}$ |  | $n_D^{39.4}$ 1.6204 |
| a-324 |  | $-\text{CS}_2-\text{C}_6\text{H}_4-\text{CH}_3$ |  | |
| a-325 |  | $-\text{CS}_2\text{CH}_2-\text{C}_6\text{H}_5$ |  | 71.9 °C |
| a-326 |  | $-\text{CS}_2\text{CH}_2-\text{C}_6\text{H}_4-\text{Cl}$ |  | |
| a-327 |  | $-\text{CS}_2\text{CH}_2-\text{C}_6\text{H}_3(\text{CH}_3)$ |  | |
| a-328 |  | $-\text{CSN}$  |  | 129.6 °C |
| a-329 |  | $-\text{CSN}$  |  | 125.8 °C |
| a-330 |  | $-\text{CH}_2\text{CN}$ |  | oily |
| a-331 |  | $-\text{CH}_2-\text{C}_6\text{H}_5$ |  | 114~ 116°C |
| a-332 |  | $-\text{CH}_2-\text{C}_6\text{H}_4-\text{Cl}$ |  | 74~ 75°C |
| a-333 |  | $-\text{CH}_2-\text{C}_6\text{H}_3(\text{Cl})$ |  | oily |
| a-334 |  | $-\text{CH}_2-\text{C}_6\text{H}_4-\text{Cl}$ |  | 123~ 127°C |

Table I-a (Continued)

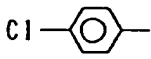
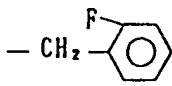
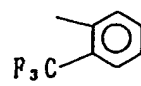
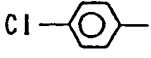
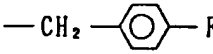
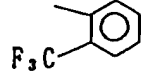
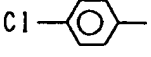
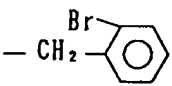
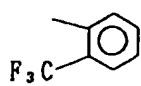
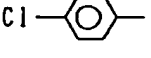
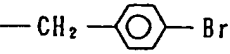
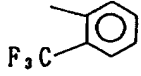
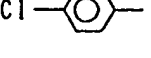
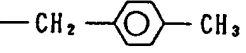
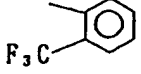
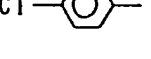
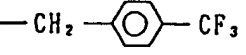
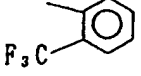

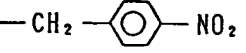
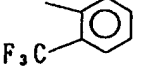

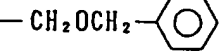
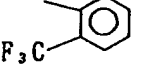

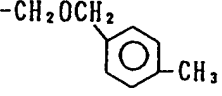
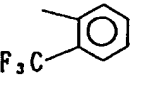
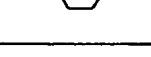
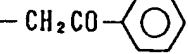
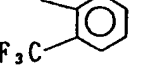
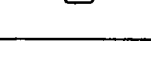
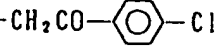
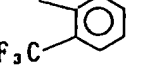

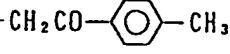
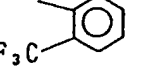
| Comp. No. | $(R_3)_m$ | R_1 | $\text{---} \text{C}_6\text{H}_4 \text{---} (R_2)_1$ | Physical Property (Melting point) |
|-----------|---|---|--|-----------------------------------|
| a-335 |  |  |  | 93~94°C |
| a-336 |  |  |  | 109~111°C |
| a-337 |  |  |  | 90~91°C |
| a-338 |  |  |  | 140~141°C |
| a-339 |  |  |  | 136~137°C |
| a-340 |  |  |  | 98~100°C |
| a-341 |  |  |  | 125~130°C |
| a-342 |  |  |  | oily |
| a-343 |  |  |  | |
| a-344 |  |  |  | 105~110°C |
| a-345 |  |  |  | |
| a-346 |  |  |  | |

Table I-a (Continued)

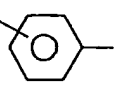

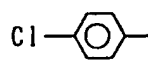
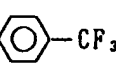
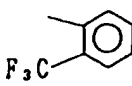
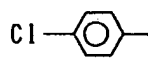

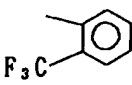
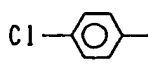

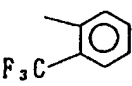
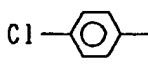
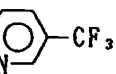
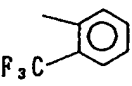
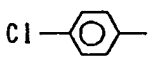
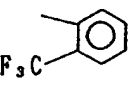
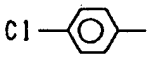
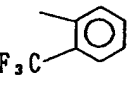
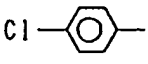
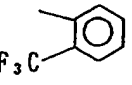
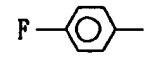
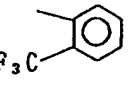
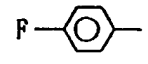

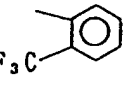
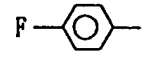
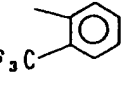
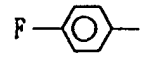
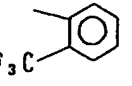
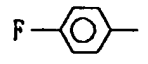
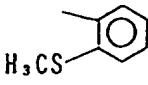
| Comp. No. | $(R_3)_n$  | R_1 |  $(R_2)_1$ | Physical Property (Melting point) |
|-----------|---|--|---|-----------------------------------|
| a-347 |  | $-\text{CH}_2\text{CO}-$  |  | |
| a-348 |  | $-\text{CH}_2-$  |  | Oily |
| a-349 |  | $-\text{CH}_2-$  |  | |
| a-350 |  | $-\text{CH}_2-$  |  | |
| a-351 |  | $-\text{CH}_2\text{COCH}_3$ |  | |
| a-352 |  | $-\text{CH}_2\text{SOCH}_3$ |  | |
| a-353 |  | $-\text{CH}_2\text{Si}(\text{CH}_3)_3$ |  | Oily |
| a-354 |  | $-\text{CH}_2\text{C}\equiv\text{Cl}$ |  | |
| a-355 |  | $-\text{COS}-$  |  | |
| a-356 |  | $-\text{SOCH}_3$ |  | |
| a-357 |  | $-\text{SO}_2\text{CH}_2\text{C}\equiv\text{CH}$ |  | |
| a-358 |  | $-\text{SO}_2\text{N}(\text{CH}_3)_2$ |  | |

Table I-a (Continued)

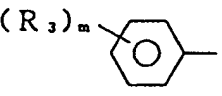

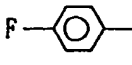
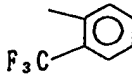
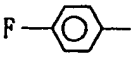
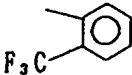
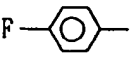
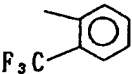
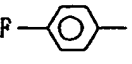
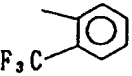
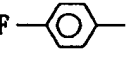
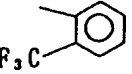
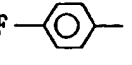
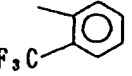
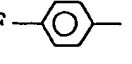

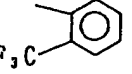
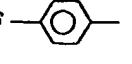

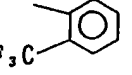
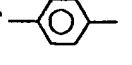
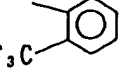
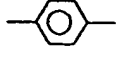
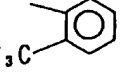
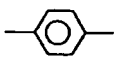
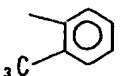
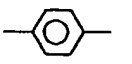

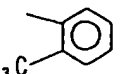
| Comp. No. | $(R_3)_m$  | R_1 |  $(R_2)_1$ | Physical Property (Melting point) |
|-----------|---|---|--|-----------------------------------|
| a-359 | F-  | $-\text{SO}_2\text{N}(\text{CH}_2\text{CH}_3)_2$ |  | 44~45°C |
| a-360 | F-  | $-\text{SO}_2\text{N}-(\text{CH}_2)_2\text{CH}_3$ $(\text{CH}_2)_2\text{CH}_3$ |  | 58~59°C |
| a-361 | F-  | $-\text{SO}_2-\text{C}_6\text{H}_4-\text{OCF}_3$ |  | |
| a-362 | F-  | $-\text{CS}_2\text{CH}_2\text{CH}_3$ |  | $n_D^{20} 1.5762$ |
| a-363 | F-  | $-\text{CSN}(\text{CH}_3)_2$ |  | 98~100°C |
| a-364 | F-  | $-\text{CSN}(\text{CH}_3)\text{CH}_2\text{CH}_3$ |  | |
| a-365 | F-  | $-\text{CSN}$  |  | 127.9 °C |
| a-366 | F-  | $-\text{CSN}$  |  | |
| a-367 | F-  | $-\text{CH}_2-\text{C}_6\text{H}_5$ |  | 101~104°C |
| a-368 | Br-  | $-\text{CH}_2\text{CH}_3$ |  | oily |
| a-369 | Br-  | $-\text{CO}-\text{C}_6\text{H}_4-\text{NO}_2$ |  | |
| a-370 | Br-  | $-\text{SO}_2-$  |  | |

Table I-a (Continued)

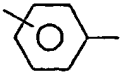


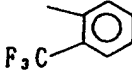

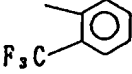


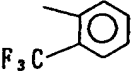

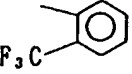

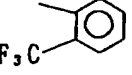

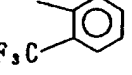

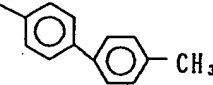


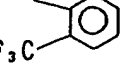


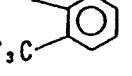

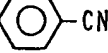
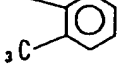


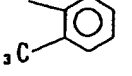


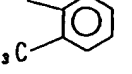
| Comp. No. | $(R_3)_m$  | R_1 |  $(R_2)_1$ | Physical Property (Melting point) |
|-----------|---|---|--|-----------------------------------|
| a-371 | Br-  | $-\text{SO}_2\text{N}(\text{CH}_2\text{CH}_3)_2$ |  | 71~73°C |
| a-372 | Br-  | $-\text{SO}_2\text{N}-(\text{CH}_2)_2\text{CH}_3$ $(\text{CH}_2)_2\text{CH}_3$ |  | 65~66°C |
| a-373 | Br-  | $-\text{SO}_2\text{N}$  |  | 173~176°C |
| a-374 | Br-  | $-\text{CSCH}_2\text{OCH}_2\text{CH}_3$ |  | |
| a-375 | Br-  | $-\text{CS}_2\text{CH}_2\text{CH}_3$ |  | 102.4 °C |
| a-376 | Br-  | $-\text{CSN}(\text{CH}_3)_2$ |  | 124~128°C |
| a-377 | Br-  | $-\text{CSN}(\text{CH}_3)_2$ |  | |
| a-378 | Br-  | $-\text{CSCH}_2$  |  | |
| a-379 | Br-  | $-\text{CS}_2\text{CH}_2$  |  | |
| a-380 | Br-  | $-\text{CS}_2\text{CH}_2$  |  | |
| a-381 | Br-  | $-\text{CSN}$  |  | 136.2 °C |
| a-382 | Br-  | $-\text{CH}_2$  |  | Oily |

Table I-a (Continued)

| Comp. No. | $(R_3)_m$ | R_1 | $(R_2)_1$ | Physical Property (Melting point) |
|-----------|-----------|--|-----------|-----------------------------------|
| a-383 | I | $-\text{COSCH}_2\text{CF}_3$ | | |
| a-384 | I | $-\text{SO}_2\text{N}(\text{CH}_2\text{CH}_3)_2$ | | Oily |
| a-385 | I | $-\text{SO}_2\text{SCH}_2$ | | |
| a-386 | I | $-\text{SO}_2\text{N}$ | | 154~ 155°C |
| a-387 | I | $-\text{CS}_2\text{CH}_3$ | | 130.2 °C |
| a-388 | I | $-\text{CSN}(\text{CH}_3)_2$ | | 141~ 144°C |
| a-389 | I | $-\text{CH}_2$ | | |
| a-390 | Cl Cl | $-\text{CH}_2\text{OCH}_3$ | | Z-isomer 68~ 70°C |
| a-391 | Cl Cl | $-\text{CH}_2\text{SCH}_3$ | | Z-isomer 113~ 118°C |
| a-392 | Cl Cl | $-\text{COCH}_2\text{OCH}_3$ | | Oily |
| a-393 | Cl Cl | $-\text{COSCH}_2\text{CH}=\text{CH}_2$ | | |
| a-394 | Cl Cl | $-\text{CO}_2\text{CH}_3$ | | Oily |

Table I-a (Continued)

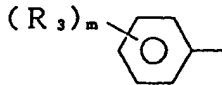
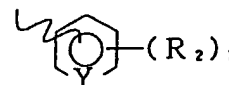
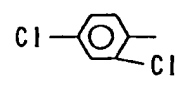
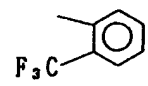
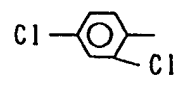
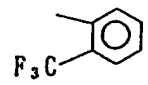
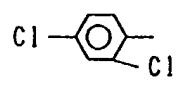
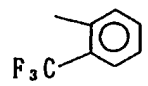
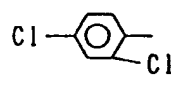
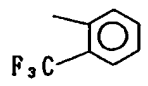
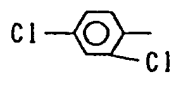
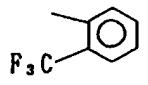
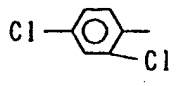
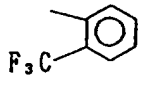
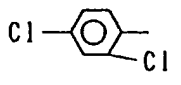
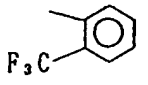
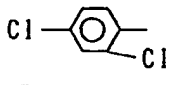
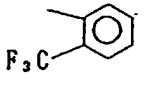
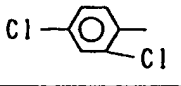
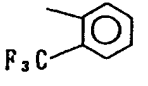
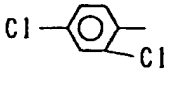
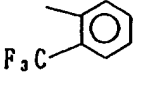
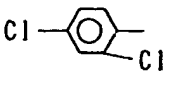
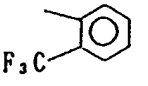
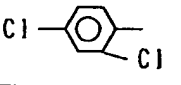
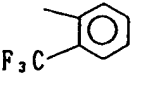
| Comp. No. | $(R_3)_m$  | R_1 |  $(R_2)_1$ | Physical Property (Melting point) |
|-----------|---|--|--|-----------------------------------|
| a-395 |  | $-\text{CO}_2\text{CH}_2\text{CH}_3$ |  | Oily |
| a-396 |  | $-\text{CO}-\text{C}_6\text{H}_4-\text{CN}$ |  | |
| a-397 |  | $-\text{CO}-\text{C}_6\text{H}_4-\text{SO}_2\text{CH}_3$ |  | |
| a-398 |  | $-\text{CO}_2-\text{C}_6\text{H}_5$ |  | Oily |
| a-399 |  | $-\text{SO}_2(\text{CH}_2)_3\text{CH}_3$ |  | Z-isomer Oily |
| a-400 |  | $-\text{SO}_2\text{SCH}_2\text{CH}=\text{CH}_2$ |  | |
| a-401 |  | $-\text{SO}_2\text{NH}(\text{CH}_2)_2\text{CH}_3$ |  | |
| a-402 |  | $-\text{SO}_2\text{NHC}(\text{CH}_3)_3$ |  | |
| a-403 |  | $-\text{SO}_2\text{N}(\text{CH}_2\text{CH}_3)_2$ |  | 124~ 125°C |
| a-404 |  | $-\text{SO}_2\text{N}-(\text{CH}_2)_2\text{CH}_3$ $(\text{CH}_2)_2\text{CH}_3$ |  | 105~ 107°C |
| a-405 |  | $-\text{SO}_2\text{N}-(\text{CH}_2)_3\text{CH}_3$ $(\text{CH}_2)_3\text{CH}_3$ |  | |
| a-406 |  | $-\text{SO}_2-\text{C}_6\text{H}_4-\text{CF}_3$ |  | |

Table I-a (Continued)

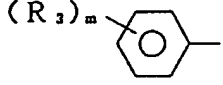
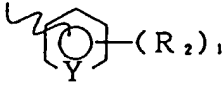
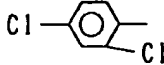
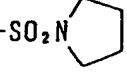
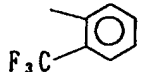
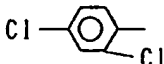
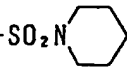
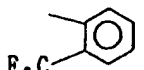
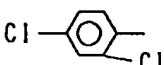
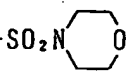
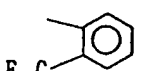
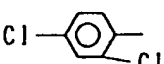
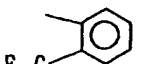
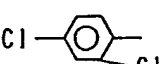
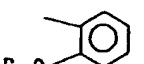
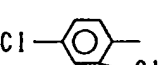
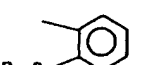
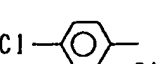
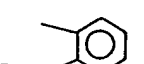
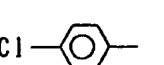
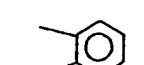
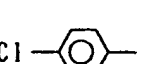
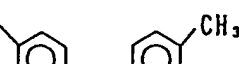
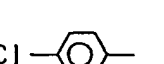
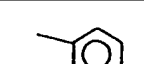
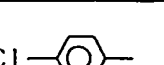
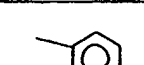

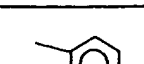
| Comp. No. | $(R_3)_m$  | R_1 |  $(R_2)_1$ | Physical Property (Melting point) |
|-----------|---|--|--|-----------------------------------|
| a-407 |  | $-\text{SO}_2\text{N}$  |  | 120~121°C |
| a-408 |  | $-\text{SO}_2\text{N}$  |  | |
| a-409 |  | $-\text{SO}_2\text{N}$  |  | |
| a-410 |  | $-\text{CSCH}_3$ |  | |
| a-411 |  | $-\text{CSCH}_2\text{CH}_3$ |  | |
| a-412 |  | $-\text{CSOCH}_3$ |  | |
| a-413 |  | $-\text{CSOCH}_2\text{CH}_3$ |  | Oily |
| a-414 |  | $-\text{CS}_2\text{CH}_3$ |  | $n_D^{20} 1.5998$ |
| a-415 |  | $-\text{CS}_2\text{CH}_2\text{CH}_3$ |  | |
| a-416 |  | $-\text{CSCH}_2\text{C}(\text{Cl})=\text{CHCl}$ |  | |
| a-417 |  | $-\text{CSN}(\text{CH}_3)_2$ |  | 97~98°C |
| a-418 |  | $-\text{CSN}(\text{CH}_2\text{CH}_3)_2$ |  | Oily |

Table I-a (Continued)

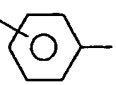

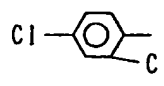

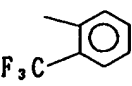
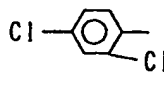

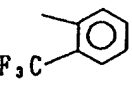
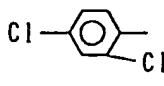

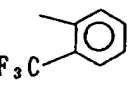
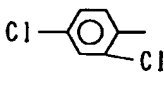
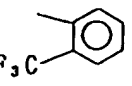
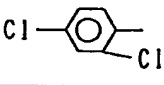
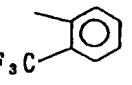
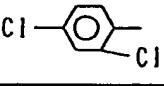
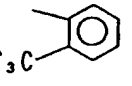
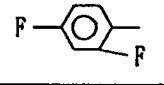
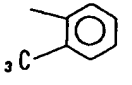
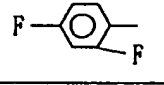
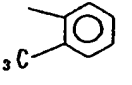
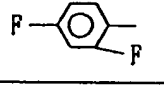

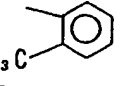
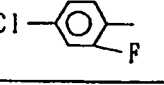
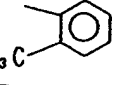
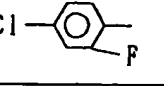
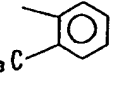
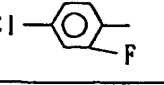
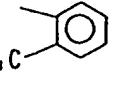
| Comp. No. | $(R_3)_m$  | R_1 |  $(R_2)_1$ | Physical Property (Melting point) |
|-----------|---|---|---|-----------------------------------|
| a-419 |  | $-\text{CSO}-$  |  | |
| a-420 |  | $-\text{CH}_2-$  |  | |
| a-421 |  | $-\text{CH}_2\text{OCH}_2-$  |  | Oily |
| a-422 |  | $-\text{CH}_2\text{CO}_2\text{CH}_3$ |  | 77~ 80°C |
| a-423 |  | $-\text{CH}_2\text{SO}_2\text{CH}_3$ |  | Z-isomer 161~ 163°C |
| a-424 |  | $-\text{CH}_2\text{SO}_2\text{CH}_3$ |  | E-isomer 175~ 178°C |
| a-425 |  | $-\text{CS}_2\text{CH}_3$ |  | $n_D^{26.8}$ 1.5680 |
| a-426 |  | $-\text{CSN}(\text{CH}_3)_2$ |  | 109.2 °C |
| a-427 |  | $-\text{CSN}$  |  | 139.1 °C |
| a-428 |  | $-\text{SO}_2\text{CH}_2\text{CH}(\text{CH}_3)_2$ |  | Oily |
| a-429 |  | $-\text{SO}_2\text{N}(\text{CH}_3)_2$ |  | 64~ 68°C |
| a-430 |  | $-\text{SO}_2\text{N}(\text{CH}_2\text{CH}_3)_2$ |  | 95~ 98°C |

Table I-a (Continued)

| Comp. No. | $(R_3)_m$ | R_1 | $(R_2)_1$ | Physical Property (Melting point) |
|-----------|-----------|--|-----------|-----------------------------------|
| a-431 | | $-\text{CSN}(\text{CH}_3)_2$ | | 87~90°C |
| a-432 | | $-\text{COSCH}_2\text{CH}=\text{CCl}_2$ | | |
| a-433 | | $-\text{SO}_2\text{SCH}_2\text{CH}=\text{CCl}_2$ | | |
| a-434 | | $-\text{SO}_2\text{N}(\text{CH}_3)_2$ | | 78~80°C |
| a-435 | | $-\text{CSN}(\text{CH}_3)_2$ | | 105~107°C |
| a-436 | | $-\text{COSCH}_2\text{C}\equiv\text{CH}$ | | |
| a-437 | | $-\text{COSCH}_2\text{C}\equiv\text{Cl}$ | | |
| a-438 | | $-\text{COCH}_3$ | | |
| a-439 | | $-\text{SO}_2\text{CH}_2\text{CH}_3$ | | |
| a-440 | | $-\text{SO}_2\text{CH}_2\text{CH}_3$ | | oily |
| a-441 | | $-\text{CS}_2\text{CH}_2\text{CH}_3$ | | |
| a-442 | | $-\text{CSN}(\text{CH}_3)_2$ | | |

Table I-a (Continued)

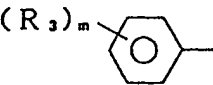


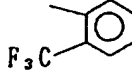


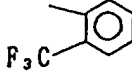


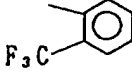


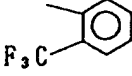

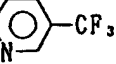
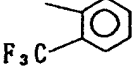


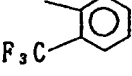


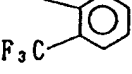


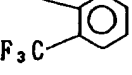

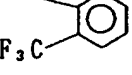

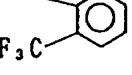

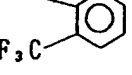

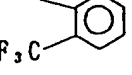
| Comp. No. | $(R_3)_m$  | R_1 |  $(R_2)_1$ | Physical Property (Melting point) |
|-----------|---|--|---|-----------------------------------|
| a-443 | Cl-  | -COSCH ₃ |  F ₃ C | Oily |
| a-444 | Cl-  | -CO-  |  F ₃ C | |
| a-445 | Cl-  | -CO-  |  F ₃ C | Oily |
| a-446 | Cl-  | -CO-  |  F ₃ C | |
| a-447 | Cl-  | -CO-  |  F ₃ C | |
| a-448 | Cl-  | -SO ₂ -  |  F ₃ C | |
| a-449 | Cl-  | -SO ₂ -  |  F ₃ C | |
| a-450 | Cl-  | -SO ₂ -  |  F ₃ C | |
| a-451 | Cl-  | -CS ₂ (CH ₂) ₂ CH ₃ |  F ₃ C | 71.9 °C |
| a-452 | Cl-  | -CS ₂ CH ₂ CO ₂ CH ₃ |  F ₃ C | $n_D^{25.6}$ 1.5825 |
| a-453 | Cl-  | -CS ₂ CH ₂ CO ₂ CH ₂ CH ₃ |  F ₃ C | |
| a-454 | F-  | -CS ₂ CH ₃ |  F ₃ C | |

Table I-a (Continued)

| Comp. No. | $(R_3)_m$ | R_1 | $(R_2)_1$ | Physical Property (Melting point) |
|-----------|-----------|--|-----------|-----------------------------------|
| a-455 | F- | $-\text{CS}_2\text{CH}_2\text{CO}_2\text{CH}_3$ | | |
| a-456 | Br- | $-\text{SO}_2\text{N}$ | | 100~ 101°C |
| a-457 | Br- | $-\text{CS}_2\text{CH}_3$ | | |
| a-458 | Br- | $-\text{CS}_2\text{CH}_2\text{CO}_2\text{CH}_3$ | | |
| a-459 | F- | $-\text{SO}_2\text{N}(\text{CH}_3)_2$ | | 115~ 118°C |
| a-460 | F- | $-\text{SO}_2\text{N}(\text{CH}_2\text{CH}_3)_2$ | | Oily |
| a-461 | Cl- | $-\text{CS}_2\text{CH}_3$ | | $n_D^{26.2}$ 1.5364 |
| a-462 | Cl- | $-\text{CO}$ | | Oily |
| a-463 | Cl- | $-\text{CO}$ | | 72~ 74°C |
| a-464 | Cl- | $-\text{CO}$ | | 152~ 155°C |
| a-465 | Cl- | $-\text{CO}$ | | 110~ 113°C |
| a-466 | Cl- | $-\text{CO}$ | | 104~ 106°C |

Table I-a (Continued)

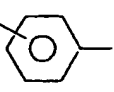

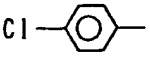
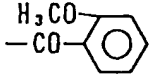
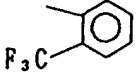
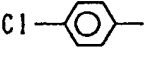
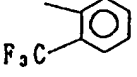
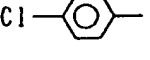
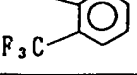
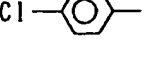
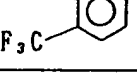
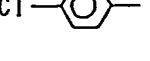
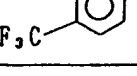


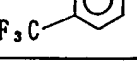


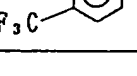
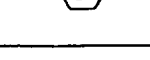
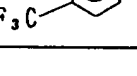
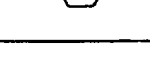
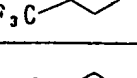
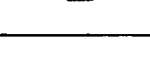
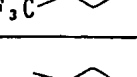
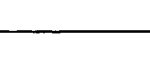

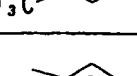

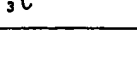
| Comp. No. | $(R_3)_m$  | R_1 |  $(R_2)_1$ | Physical Property (Melting point) |
|-----------|---|---|---|-----------------------------------|
| a-467 |  |  |  | 99~101°C |
| a-468 |  | $-\text{COS}(\text{CH}_2)_2\text{CH}_3$ |  | |
| a-469 |  | $-\text{CONHCH}_3$ |  | oily |
| a-470 |  | $-\text{SO}_2\text{N}(\text{CH}_3)\text{CH}_2\text{CH}_3$ |  | 98~100°C |
| a-471 |  | $-\text{SO}_2\text{N}-(\text{CH}_2)_2\text{CH}_3$ CH_3 |  | 55~57°C |
| a-472 |  | $-\text{S}-$  |  | oily |
| a-473 |  | $-\text{SO}-$  |  | 188~191°C |
| a-474 |  | $-\text{SCCl}_3$ |  | oily |
| a-475 |  | $-\text{SN}(\text{CH}_3)_2$ |  | oily |
| a-476 |  | $-\text{SN}(\text{CH}_2\text{CH}_3)_2$ |  | |
| a-477 |  | $-\text{SN}$  |  | |
| a-478 |  | $-\text{SCH}_2\text{CH}_3$ |  | |

Table I-a (Continued)

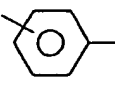


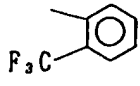

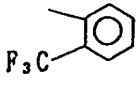

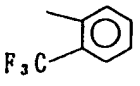

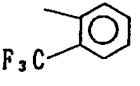

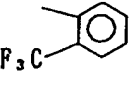

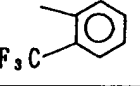

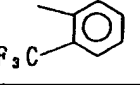

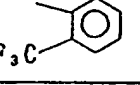

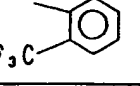

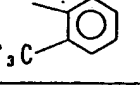

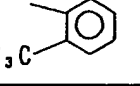

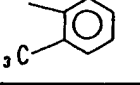
| Comp. No. | $(R_3)_m$  | R_1 |  $(R_2)_1$ | Physical Property (Melting point) |
|-----------|---|-------------------|---|-----------------------------------|
| a-479 | Cl-  | $-S(CH_2)_2CH_3$ |  | |
| a-480 | Cl-  | $-SCH(CH_3)_2$ |  | |
| a-481 | Cl-  | $-SC(CH_3)_3$ |  | |
| a-482 | Cl-  | $-SCH_2Cl$ |  | |
| a-483 | Cl-  | $-SCHCl_2$ |  | |
| a-484 | Cl-  | $-SCH_2OCH_3$ |  | |
| a-485 | Cl-  | $-SCH_2SCH_3$ |  | |
| a-486 | Cl-  | $-SCH_2N(CH_3)_2$ |  | |
| a-487 | Cl-  | $-S_2CH_3$ |  | |
| a-488 | Cl-  | $-S_2CH_2CH_3$ |  | Oily |
| a-489 | Cl-  | $-S_2CH(CH_3)_2$ |  | |
| a-490 | Cl-  | $-S_2C(CH_3)_3$ |  | |

Table I-a (Continued)

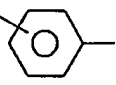

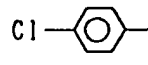
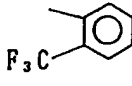
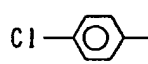
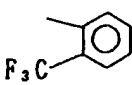
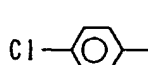

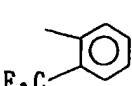
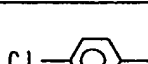
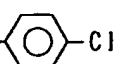
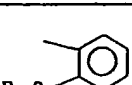
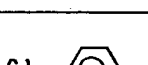
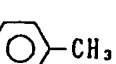
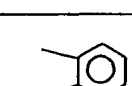
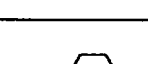
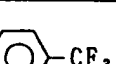
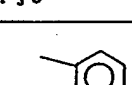
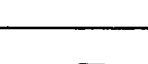
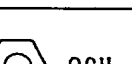
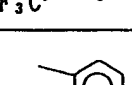
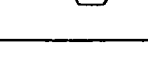
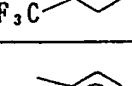
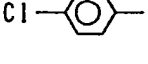
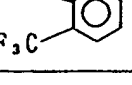
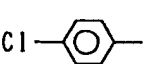
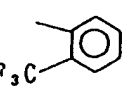
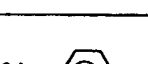
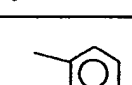

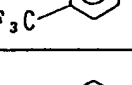
| Comp. No. | $(R_3)_m$  | R_1 |  $(R_2)_1$ | Physical Property (Melting point) |
|-----------|---|--|---|-----------------------------------|
| a-491 |  | $-\text{SN}(\text{CH}_3)\text{OCH}_3$ |  | |
| a-492 |  | $-\text{SN}(\text{CH}_2\text{CH}_3)\text{OCH}_3$ |  | |
| a-493 |  | $-\text{S}_2-$  |  | |
| a-494 |  | $-\text{S}_2-$  |  | |
| a-495 |  | $-\text{S}_2-$  |  | |
| a-496 |  | $-\text{S}_2-$  |  | |
| a-497 |  | $-\text{S}_2-$  |  | |
| a-498 |  | $-\text{SO}_2\text{N}(\text{CH}_3)\text{OCH}_3$ |  | |
| a-499 |  | $-\text{SO}_2\text{N}-\text{OCH}_3$ CH_2CH_3 |  | |
| a-500 |  | $-\text{SO}_2\text{CH}_2\text{N}(\text{CH}_3)_2$ |  | |
| a-501 |  | $-\text{SO}_2(\text{CH}_2)_2\text{N}-\text{CH}_3$ CH_3 |  | |
| a-502 |  | $-\text{SO}_2(\text{CH}_2)_2\text{OCH}_3$ |  | |

Table I-a (Continued)



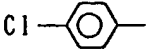
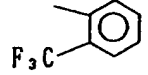
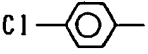
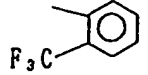
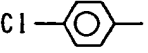

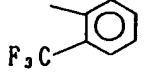
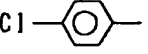

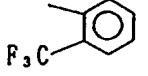
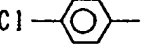

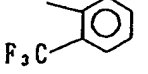
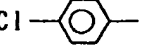

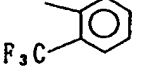
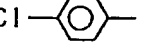

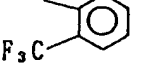
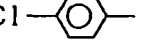

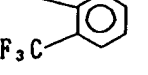
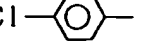

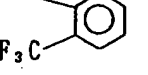
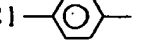

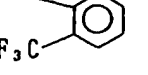
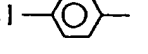

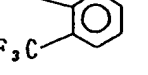
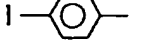

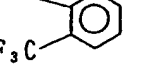
| Comp. No. | $(R_3)_m$  | R_1 |  $(R_2)_1$ | Physical Property (Melting point) |
|-----------|---|---|---|-----------------------------------|
| a-503 |  | $-\text{SO}_2\text{CH}_2\text{SCH}_3$ |  | |
| a-504 |  | $-\text{SO}_2(\text{CH}_2)_2\text{SCH}_3$ |  | |
| a-505 |  | $-\text{SO}_2$  |  | |
| a-506 |  | $-\text{SO}_2\text{N}$  |  | |
| a-507 |  | $-\text{SO}_2\text{N}$  |  | |
| a-508 |  | $-\text{SO}_2$  |  | |
| a-509 |  | $-\text{SO}_2$  |  | |
| a-510 |  | $-\text{SO}_2$  |  | |
| a-511 |  | $-\text{SO}_2$  |  | |
| a-512 |  | $-\text{SO}_2$  |  | |
| a-513 |  | $-\text{SO}_2$  |  | |
| a-514 |  | $-\text{SO}_2$  |  | |

Table I-a (Continued)

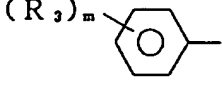
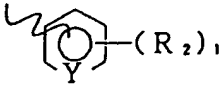
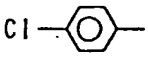
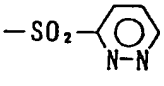
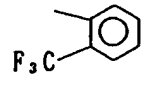
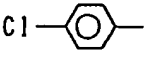
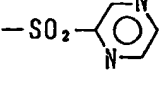
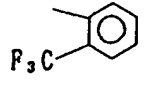
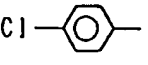
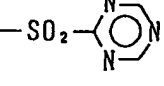
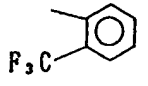
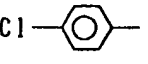
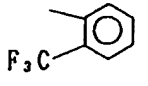
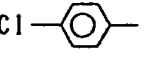
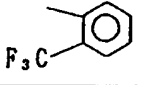
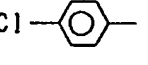
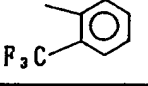
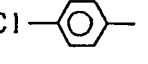
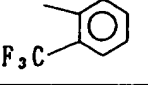
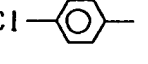
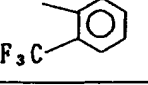
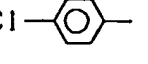
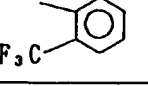
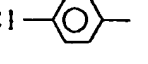
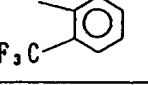
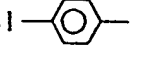
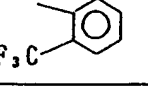
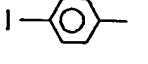
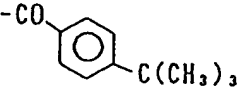
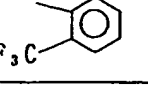
| Comp. No. | $(R_3)_m$  | R_1 |  $(R_2)_1$ | Physical Property (Melting point) |
|-----------|---|---|--|-----------------------------------|
| a-515 |  |  |  | |
| a-516 |  |  |  | |
| a-517 |  |  |  | |
| a-518 |  | $-\text{SON}(\text{CH}_3)_2$ |  | |
| a-519 |  | $-\text{SON}(\text{CH}_2\text{CH}_3)_2$ |  | |
| a-520 |  | $-\text{SON}(\text{CH}_3)\text{OCH}_3$ |  | |
| a-521 |  | $-\text{SON}(\text{CH}_2\text{CH}_3)\text{OCH}_3$ |  | |
| a-522 |  | $-\text{S}(=\text{O})\text{OCH}_3$ |  | |
| a-523 |  | $-\text{S}(=\text{O})\text{OCH}_2\text{CH}_3$ |  | |
| a-524 |  | $-\text{S}(=\text{O})\text{SCH}_3$ |  | |
| a-525 |  | $-\text{S}(=\text{O})\text{SCH}_2\text{CH}_3$ |  | |
| a-526 |  |  |  | 118~120°C |

Table I-a (Continued)

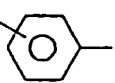

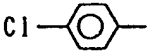
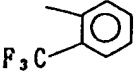
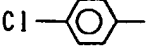
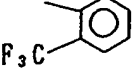
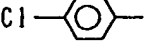
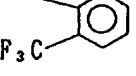
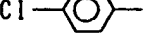
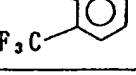
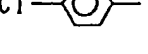
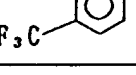

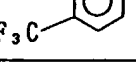

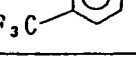

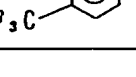

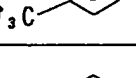
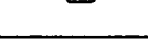
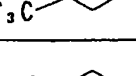
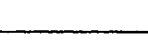
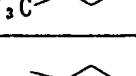

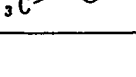
| Comp. No. | $(R_3)_m$  | R_1 |  $(R_2)_1$ | Physical Property (Melting point) |
|-----------|---|---|---|-----------------------------------|
| a-527 |  | $-\text{CO}-\text{C}_6\text{H}_4-\text{CF}_3$ |  | |
| a-528 |  | $-\text{COCH}_2\text{SOCH}_3$ |  | |
| a-529 |  | $-\text{COCH}_2\text{SO}_2\text{CH}_3$ |  | |
| a-530 |  | $-\text{CO}(\text{CH}_2)_2\text{NH}_2$ |  | |
| a-531 |  | $-\text{COCH}_2\text{NHCH}_3$ |  | |
| a-532 |  | $-\text{COCH}_2\text{N}(\text{CH}_3)_2$ |  | |
| a-533 |  | $-\text{CO}_2\text{CH}_2-\text{C}_6\text{H}_5$ |  | |
| a-534 |  | $-\text{CO}_2\text{CH}_2-\text{C}_6\text{H}_4-\text{SO}_2\text{CF}_3$ |  | |
| a-535 |  | $\text{F}_3\text{C}-\text{C}_6\text{H}_4-\text{CO}-$ |  | 123~124°C |
| a-536 |  | $-\text{CO}-\text{C}_6\text{H}_4-\text{CH}(\text{CH}_3)_2$ |  | 125~128°C |
| a-537 |  | $-\text{CO}-\text{C}_6\text{H}_4-\text{OCH}(\text{CH}_3)_2$ |  | 28~30°C |
| a-538 |  | $-\text{CO}-\text{C}_6\text{H}_4-\text{SCH}_3$ |  | |

Table I-a (Continued)

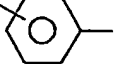



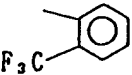

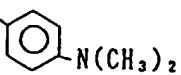
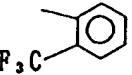


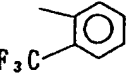

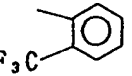

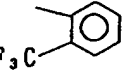

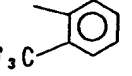

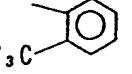

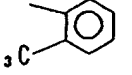

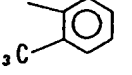

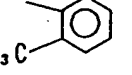


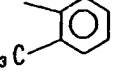


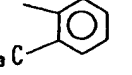
| Comp. No. | $(R_3)_m$  | R_1 |  $(R_2)_1$ | Physical Property (Melting point) |
|-----------|---|---|---|-----------------------------------|
| a-539 | Cl-  | -CO-  -SO ₂ CH ₃ |  | |
| a-540 | Cl-  | -CO-  |  | 170~ 175°C |
| a-541 | Cl-  | (CH ₃) ₂ N-  |  | |
| a-542 | Cl-  | -CSOCH(CH ₃) ₂ |  | |
| a-543 | Cl-  | -CSOC(CH ₃) ₃ |  | |
| a-544 | Cl-  | -CSOCH ₂ CF ₃ |  | |
| a-545 | Cl-  | -CSOCH ₂ CH=CH ₂ |  | |
| a-546 | Cl-  | -CSOCH ₂ C≡CH |  | |
| a-547 | Cl-  | -CSOCH ₂ CH=CCl ₂ |  | |
| a-548 | Cl-  | -CSOCH ₂ C≡Cl |  | |
| a-549 | Cl-  | -CSO-  |  | |
| a-550 | Cl-  | -CSOCH ₂ -  |  | |

Table I-a (Continued)

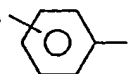

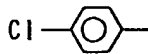
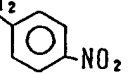
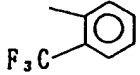
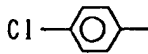
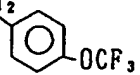
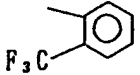
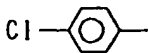
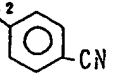
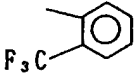
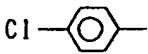
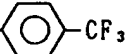
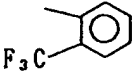
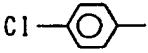
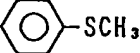
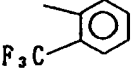
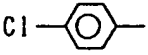
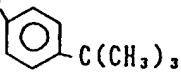
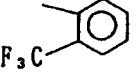
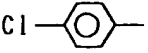

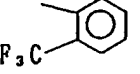
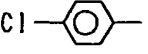

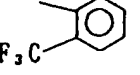
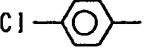

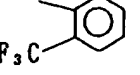
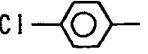

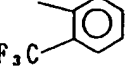
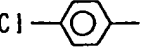

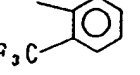
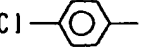

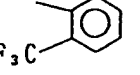
| Comp. No. | $(R_3)_m$  | R_1 |  $(R_2)_1$ | Physical Property (Melting point) |
|-----------|---|---|--|-----------------------------------|
| a-551 |  | $-\text{CSOCH}_2$  |  | |
| a-552 |  | $-\text{CSOCH}_2$  |  | |
| a-553 |  | $-\text{CSOCH}_2$  |  | |
| a-554 |  | $-\text{CSO}$  |  | |
| a-555 |  | $-\text{CSO}$  |  | |
| a-556 |  | $-\text{CSO}$  |  | |
| a-557 |  | $-\text{CSO}$  |  | |
| a-558 |  | $-\text{CH}_2\text{S}$  |  | |
| a-559 |  | $-\text{CH}_2\text{SO}$  |  | |
| a-560 |  | $-\text{CH}_2\text{SO}_2$  |  | |
| a-561 |  | $-(\text{CH}_2)_2$  |  | |
| a-562 |  | $-\text{CH}_2\text{O}$  |  | |

Table I-a (Continued)

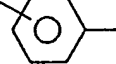



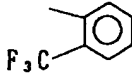

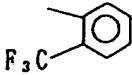

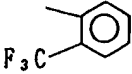

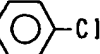
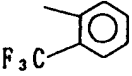

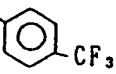
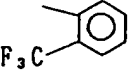


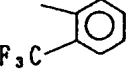


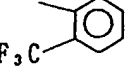


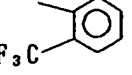


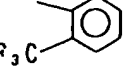


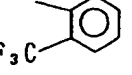


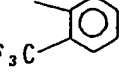


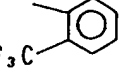
| Comp. No. | $(R_3)_m$  | R_1 |  $(R_2)_1$ | Physical Property (Melting point) |
|-----------|---|---|---|-----------------------------------|
| a-563 | Cl-  | $-\text{CH}_2\text{SCH}_2-$  |  | |
| a-564 | Cl-  | $-\text{CH}_2\text{CSCH}_3$ |  | |
| a-565 | Cl-  | $-\text{CH}_2\text{CSOCH}_3$ |  | |
| a-566 | Cl-  | $-\text{CH}_2\text{S}-$  |  | |
| a-567 | Cl-  | $-(\text{CH}_2)_2-$  |  | |
| a-568 | Cl-  | $-\text{CO}_2-$  |  | |
| a-569 | Cl-  | $-\text{CO}_2-$  |  | |
| a-570 | Cl-  | $-\text{CO}_2-$  |  | |
| a-571 | Cl-  | $-\text{CO}_2-$  |  | |
| a-572 | Cl-  | $-\text{CO}_2-$  |  | |
| a-573 | Cl-  | $-\text{CS}_2-$  |  | E-isomer 116.1 °C |
| a-574 | Cl-  | $-\text{CS}_2-$  |  | Z-isomer n_D^{20} 1.5716 |

Table I-a (Continued)

| Comp. No. | $(R_3)_m$ | R_1 | $(R_2)_1$ | Physical Property (Melting point) |
|-----------|-----------|-------|-----------|-----------------------------------|
| a-575 | | | | |
| a-576 | | | | |
| a-577 | | | | |
| a-578 | | | | |
| a-579 | | | | |
| a-580 | | | | |
| a-581 | | | | |
| a-582 | | | | |
| a-583 | | | | |
| a-584 | | | | |
| a-585 | | | | |
| a-586 | | | | |

Table I-a (Continued)

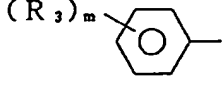
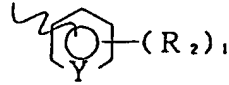
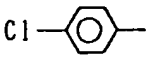
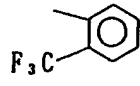
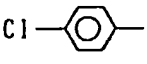
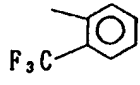
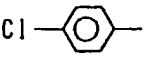
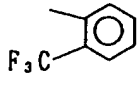
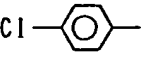
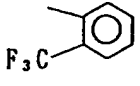
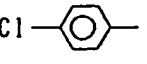
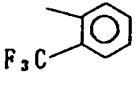
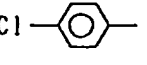
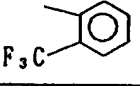
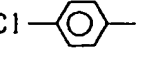
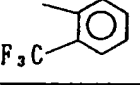
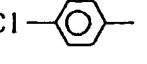

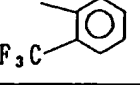
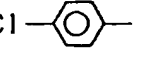

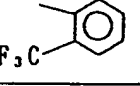
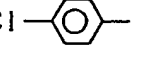

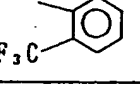
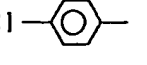

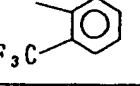
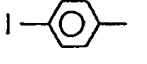
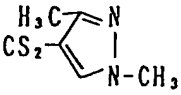
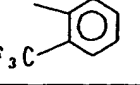
| Comp. No. | $(R_3)_m$  | R_1 |  $(R_2)_1$ | Physical Property (Melting point) |
|-----------|---|--|--|-----------------------------------|
| a-587 |  | $-\text{CS}_2(\text{CH}_2)_2\text{NCH}_3$ CH_3 |  | |
| a-588 |  | $-\text{CS}_2(\text{CH}_2)_2\text{SCH}_3$ |  | |
| a-589 |  | $-\text{CS}_2(\text{CH}_2)_2\text{S}$ CH_2CH_3 |  | |
| a-590 |  | $-\text{CS}_2(\text{CH}_2)_2\text{CN}$ |  | |
| a-591 |  | $-\text{CS}_2(\text{CH}_2)_2\text{NO}_2$ |  | |
| a-592 |  | $-\text{CS}_2(\text{CH}_2)_2\text{OCHF}_2$ |  | |
| a-593 |  | $-\text{CS}_2\text{CCl}_3$ |  | |
| a-594 |  | $-\text{CS}_2$  |  | |
| a-595 |  | $-\text{CS}_2$  |  | |
| a-596 |  | $-\text{CS}_2$  |  | |
| a-597 |  | $-\text{CS}_2$  |  | |
| a-598 |  | $-\text{CS}_2$  |  | |

Table I-a (Continued)

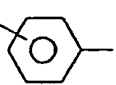


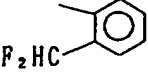

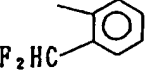

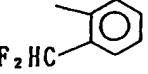

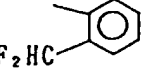

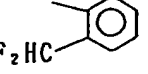

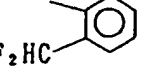

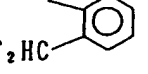

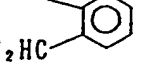

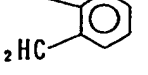

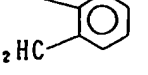

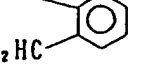


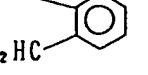
| Comp. No. | $(R_3)_m$  | R_1 |  $(R_2)_1$ | Physical Property (Melting point) |
|-----------|---|--|---|-----------------------------------|
| a-599 | Cl-  | -COCH ₃ |  F ₂ HC | |
| a-600 | Cl-  | -COCH ₂ CH ₃ |  F ₂ HC | |
| a-601 | Cl-  | -COCH(CH ₃) ₂ |  F ₂ HC | |
| a-602 | Cl-  | -COC(CH ₃) ₃ |  F ₂ HC | |
| a-603 | Cl-  | -SO ₂ CH ₃ |  F ₂ HC | |
| a-604 | Cl-  | -SO ₂ CH ₂ CH ₃ |  F ₂ HC | |
| a-605 | Cl-  | -SO ₂ N(CH ₃) ₂ |  F ₂ HC | |
| a-606 | Cl-  | -SO ₂ N(CH ₂ CH ₃) ₂ |  F ₂ HC | |
| a-607 | Cl-  | -SO ₂ NCH ₂ CH ₃ CH ₃ |  F ₂ HC | |
| a-608 | Cl-  | -CO ₂ CH ₃ |  F ₂ HC | |
| a-609 | Cl-  | -CO ₂ CH ₂ CH ₃ |  F ₂ HC | |
| a-610 | Cl-  | -CO-  |  F ₂ HC | |

Table I-a (Continued)

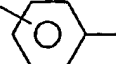


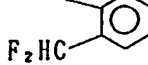

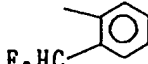


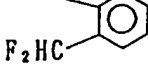

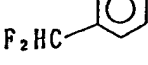

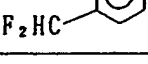

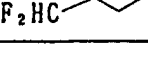

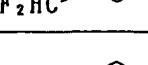

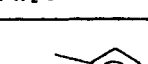

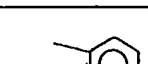

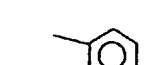

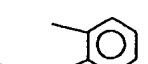


| Comp. No. | $(R_3)_m$  | R_1 |  $(R_2)_1$ | Physical Property (Melting point) |
|-----------|---|---|--|-----------------------------------|
| a-611 | Cl-  | -CSOCH ₃ |  | |
| a-612 | Cl-  | -CSOCH ₂ CH ₃ |  | |
| a-613 | Cl-  | -CSO-  |  | |
| a-614 | Cl-  | -CSN(CH ₃) ₂ |  | |
| a-615 | Cl-  | -CS ₂ CH ₃ |  | |
| a-616 | Cl-  | -CS ₂ CH ₂ CH ₃ |  | |
| a-617 | Cl-  | -CS ₂ CH ₂ CH=CH ₂ |  | |
| a-618 | Cl-  | -CSN(CH ₃) ₂ |  | |
| a-619 | Cl-  | -CS ₂ CH ₃ |  | |
| a-620 | Cl-  | -CS ₂ CH ₂ CH ₃ |  | |
| a-621 | Cl-  | -CS ₂ CH ₂ CH=CH ₂ |  | |
| a-622 | Cl-  | -SO ₂ N(CH ₃) ₂ |  | |

Table I-a (Continued)

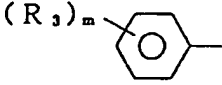
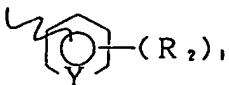
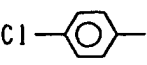
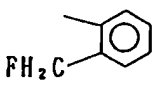
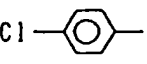
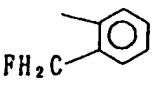
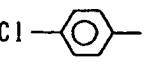
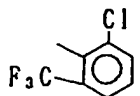
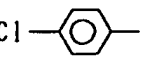
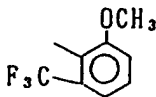
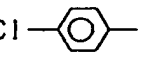
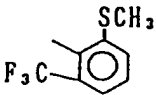
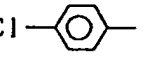
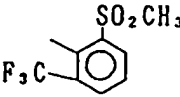
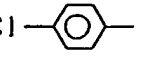
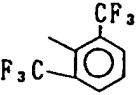
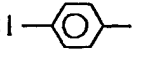
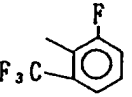
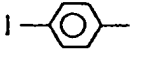
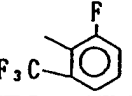
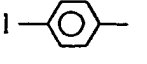
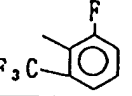
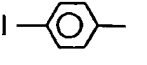
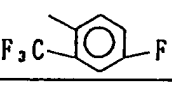
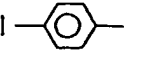
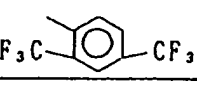
| Comp. No. | $(R_3)_m$  | R_1 |  $(R_2)_1$ | Physical Property (Melting point) |
|-----------|---|---|--|-----------------------------------|
| a-623 |  | $-\text{SO}_2\text{N}(\text{CH}_2\text{CH}_3)_2$ |  | |
| a-624 |  | $-\text{SO}_2\text{N}(\text{CH}_2\text{CH}_3)\text{CH}_3$ |  | |
| a-625 |  | $-\text{COCH}_3$ |  | |
| a-626 |  | $-\text{COCH}(\text{CH}_3)_2$ |  | |
| a-627 |  | $-\text{COC}(\text{CH}_3)_3$ |  | |
| a-628 |  | $-\text{SO}_2\text{CH}_3$ |  | |
| a-629 |  | $-\text{SO}_2\text{CH}_2\text{CH}_3$ |  | |
| a-630 |  | $-\text{SO}_2\text{N}(\text{CH}_3)_2$ |  | |
| a-631 |  | $-\text{SO}_2\text{N}(\text{CH}_2\text{CH}_3)_2$ |  | |
| a-632 |  | $-\text{SO}_2\text{N}(\text{CH}_2\text{CH}_3)\text{CH}_3$ |  | |
| a-633 |  | $-\text{SO}_2\text{N}(\text{CH}_3)_2$ |  | |
| a-634 |  | $-\text{SO}_2\text{N}(\text{CH}_3)_2$ |  | |

Table I-a (Continued)

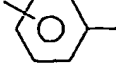


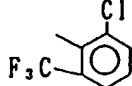

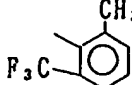

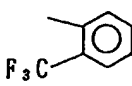

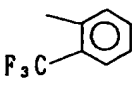

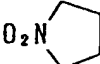
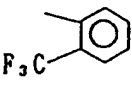

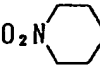
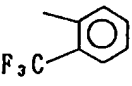

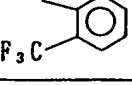

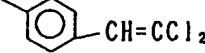

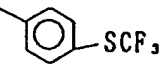

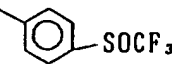

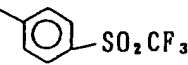

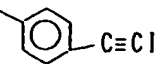
| Comp. No. | $(R_3)_m$  | R_1 |  $(R_2)_1$ | Physical Property (Melting point) |
|-----------|---|--|---|-----------------------------------|
| a-635 | Cl-  | $-\text{SO}_2\text{N}(\text{CH}_3)_2$ |  | |
| a-636 | Cl-  | $-\text{SO}_2\text{N}(\text{CH}_3)_2$ |  | |
| a-637 | F-  | $-\text{COSCH}_3$ |  | Oily |
| a-638 | F-  | $-\text{COSCH}_2\text{CH}_3$ |  | Oily |
| a-639 | F-  | $-\text{SO}_2\text{N}$  |  | 107~ 110°C |
| a-640 | F-  | $-\text{SO}_2\text{N}$  |  | 83~ 84°C |
| a-641 | Br-  | $-\text{SO}_2\text{NCH}_2\text{CH}_3$ CH_3 |  | 110~ 111°C |
| a-642 | F-  | $-\text{COCH}_3$ |  | |
| a-643 | Cl-  | $-\text{COCH}_2\text{CH}_3$ |  | |
| a-644 | Br-  | $-\text{COCH}(\text{CH}_3)_2$ |  | |
| a-645 | I-  | $-\text{COC}(\text{CH}_3)_3$ |  | |
| a-646 | F-  | $-\text{SO}_2\text{CH}_3$ |  | |

Table I-a (Continued)

| Comp. No. | $(R_3)_m$ | R_1 | $(R_2)_1$ | Physical Property (Melting point) |
|-----------|----------------------------------|---|-----------|-----------------------------------|
| a-647 | | $-\text{SO}_2\text{CH}_2\text{CH}_3$ | | |
| a-648 | | $-\text{SO}_2\text{N}(\text{CH}_3)_2$ | | |
| a-649 | $(\text{H}_3\text{C})_3\text{C}$ | $-\text{SO}_2\text{N}(\text{CH}_2\text{CH}_3)_2$ | | |
| a-650 | | $-\text{SO}_2\text{N}(\text{CH}_3)\text{CH}_2\text{CH}_3$ | | |
| a-651 | | $-\text{SO}_2\text{N}$ | | |
| a-652 | | $-\text{CO}_2\text{CH}_3$ | | |
| a-653 | | $-\text{CO}_2\text{CH}_2\text{CH}_3$ | | |
| a-654 | | $-\text{CO}$ | | |
| a-655 | | $-\text{CO}$ | | |
| a-656 | | $-\text{CSOCH}_3$ | | |
| a-657 | $(\text{H}_3\text{C})_3\text{C}$ | $-\text{CSOCH}_2\text{CH}_3$ | | |
| a-658 | | $-\text{CSO}$ | | |

Table I-a (Continued)

| Comp. No. | $(R_3)_m$ | R_1 | $(R_2)_1$ | Physical Property (Melting point) |
|-----------|-----------|---|-----------|------------------------------------|
| a-659 | | $-\text{CSN}(\text{CH}_3)_2$ | | |
| a-660 | | $-\text{CS}_2\text{CH}_3$ | | |
| a-661 | | $-\text{CS}_2\text{CH}_2\text{CH}_3$ | | |
| a-662 | | $-\text{SO}_2\text{N}(\text{CH}_2)_2\text{CH}_3$ $ $ $(\text{CH}_2)_2\text{CH}_3$ | | 57~ 58°C |
| a-663 | | $-\text{SO}_2\text{N}$ | | 119~ 120°C |
| a-664 | | $-\text{SO}_2\text{NCH}_2\text{CH}_3$ $ $ CH_3 | | 130~ 132°C |
| a-665 | | $-\text{CS}_2\text{CH}_3$ | | $n_D^{30.2}$ 1.5922 |
| a-666 | | $-\text{CS}_2\text{CH}_3$ | | E-isomer 79.2°C |
| a-667 | | $-\text{CS}_2\text{CH}_3$ | | Z-isomer $n_D^{18.6}$ 1.6004 |
| a-668 | | $-\text{CS}_2\text{CH}_3$ | | $n_D^{38.8}$ 1.5062 |
| a-669 | | $-\text{SO}_2\text{CH}_3$ | | |
| a-670 | | $-\text{SO}_2\text{CH}_2\text{CH}_3$ | | |

Table I-a (Continued)

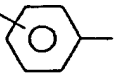

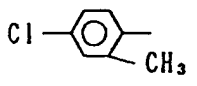
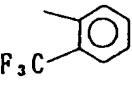
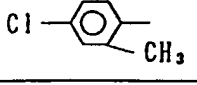
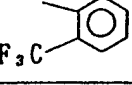
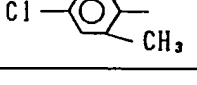
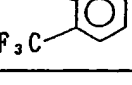
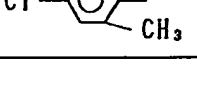
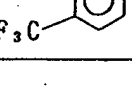
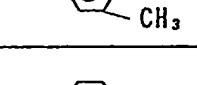
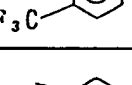
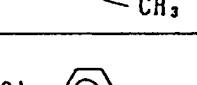
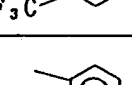
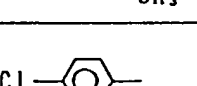

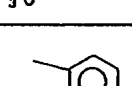
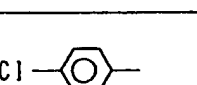
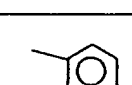
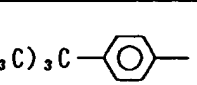
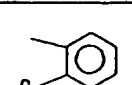

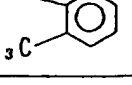

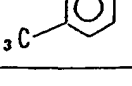


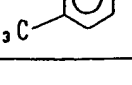
| Comp. No. | $(R_3)_m$  | R_1 |  $(R_2)_1$ | Physical Property (Melting point) |
|-----------|---|--|---|-----------------------------------|
| a-671 |  | $-\text{SO}_2\text{N}(\text{CH}_3)_2$ |  | |
| a-672 |  | $-\text{SO}_2\text{N}(\text{CH}_2\text{CH}_3)_2$ |  | |
| a-673 |  | $-\text{SO}_2\text{NCH}_2\text{CH}_3$ $\quad\quad\quad\text{CH}_3$ |  | |
| a-674 |  | $-\text{SCH}_3$ |  | |
| a-675 |  | $-\text{SCH}_2\text{CH}_3$ |  | |
| a-676 |  | $-\text{SCCl}_3$ |  | |
| a-677 |  | $-\text{S}-$  |  | |
| a-678 |  | $-\text{SN}(\text{CH}_3)_2$ |  | |
| a-679 |  | $-\text{SN}(\text{CH}_2\text{CH}_3)_2$ |  | |
| a-680 | $(\text{H}_3\text{C})_3\text{C}-$  | $-\text{CSOCH}_3$ |  | Oily |
| a-681 | $(\text{H}_3\text{C})_3\text{C}-$  | $-\text{CSOCH}_2\text{CH}_3$ |  | Oily |
| a-682 | $(\text{H}_3\text{C})_3\text{C}-$  | $-\text{CSO}-$  |  | Oily |

Table I-a (Continued)

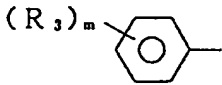
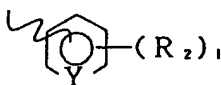
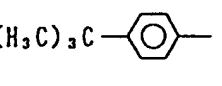
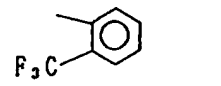
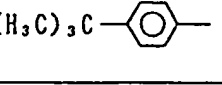
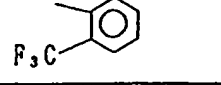
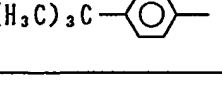
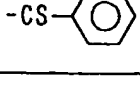
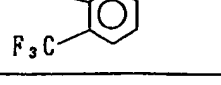
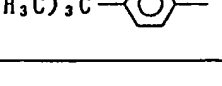
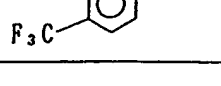
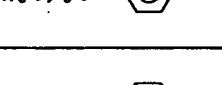
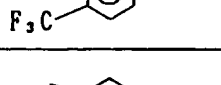
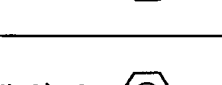
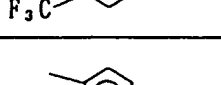
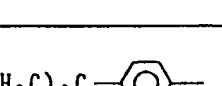
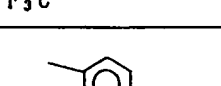
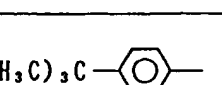
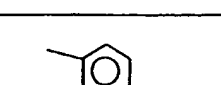
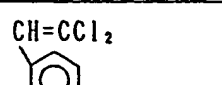
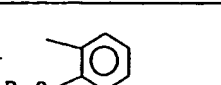
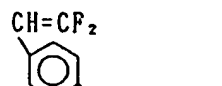
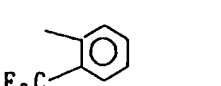

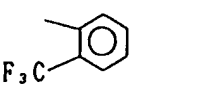


| Comp. No. | $(R_3)_m$  | R_1 |  $(R_2)_1$ | Physical Property (Melting point) |
|-----------|---|---|--|-----------------------------------|
| a-683 | $(H_3C)_3C$  | $-COSCH_3$ |  | Oily |
| a-684 | $(H_3C)_3C$  | $-COSCH_2CH_3$ |  | 116~ 117°C |
| a-685 | $(H_3C)_3C$  | $-CS$  |  | |
| a-686 | $(H_3C)_3C$  | $-CS_2CH_3$ |  | $n_D^{20} 1.5746$ |
| a-687 | $(H_3C)_3C$  | $-SCH_3$ |  | |
| a-688 | $(H_3C)_3C$  | $-SCH_2CH_3$ |  | |
| a-689 | $(H_3C)_3C$  | $-SCCl_3$ |  | |
| a-690 | $(H_3C)_3C$  | $-SN(CH_3)_2$ |  | |
| a-691 | $(H_3C)_3C$  | $-SN(CH_2CH_3)_2$ |  | |
| a-692 | $CH=CCl_2$  | $-CS_2CH_3$ |  | 103.6°C |
| a-693 | $CH=CF_2$  | $-CS_2CH_3$ |  | |
| a-694 | SCF_3  | $-CS_2CH_3$ |  | |

Table I-a (Continued)

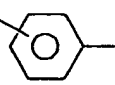


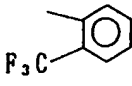

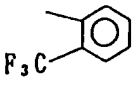

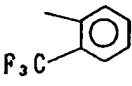
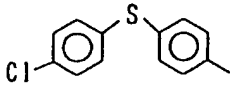
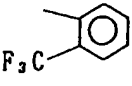
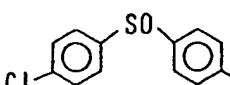
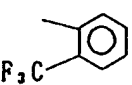
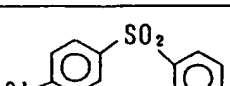
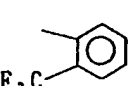

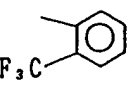

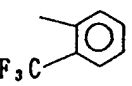

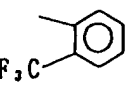

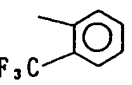

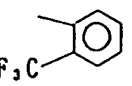

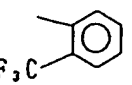
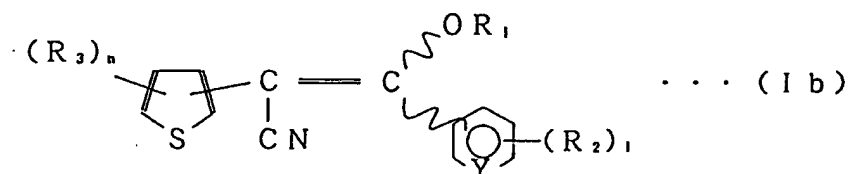
| Comp. No. | $(R_3)_m$  | R_1 |  $(R_2)_1$ | Physical Property (Melting point) |
|-----------|---|---------------------------|---|-----------------------------------|
| a-695 |  | $-\text{CS}_2\text{CH}_3$ |  | |
| a-696 |  | $-\text{CS}_2\text{CH}_3$ |  | |
| a-697 |  | $-\text{CS}_2\text{CH}_3$ |  | |
| a-698 |  | $-\text{CS}_2\text{CH}_3$ |  | |
| a-699 |  | $-\text{CS}_2\text{CH}_3$ |  | |
| a-700 |  | $-\text{CS}_2\text{CH}_3$ |  | |
| a-701 |  | $-\text{CS}_2\text{CH}_3$ |  | |
| a-702 |  | $-\text{CS}_2\text{CH}_3$ |  | |
| a-703 |  | $-\text{CS}_2\text{CH}_3$ |  | |
| a-704 |  | $-\text{CS}_2\text{CH}_3$ |  | |
| a-705 |  | $-\text{CS}_2\text{CH}_3$ |  | |
| a-706 |  | $-\text{CS}_2\text{CH}_3$ |  | |

Table I-a (Continued)

| Comp. No. | $(R_3)_m$ | R_1 | $(R_2)_1$ | Physical Property (Melting point) |
|-----------|--|----------------------------------|-----------|-----------------------------------|
| a-707 | SOCH ₂ C≡Cl | -CS ₂ CH ₃ | | |
| a-708 | SO ₂ CH ₂ C≡Cl | -CS ₂ CH ₃ | | |
| a-709 | Cl | -CS ₂ CH ₃ | | |
| a-710 | Cl | -CS ₂ CH ₃ | | |
| a-711 | Cl | -CS ₂ CH ₃ | | |
| a-712 | | -CS ₂ CH ₃ | | |
| a-713 | Br | -CS ₂ CH ₃ | | 88.0°C |

Table I-b



| Comp. No. | (R ₃) _n | R ₁ | (R ₂) ₁ | Physical property (Melting point) |
|-----------|--------------------------------|--|--------------------------------|-----------------------------------|
| b-1 | | -CSOCH ₃ | | |
| b-2 | | -CSOCH ₂ CH ₃ | | |
| b-3 | | -CSO-C ₆ H ₅ | | |
| b-4 | | -CSCH ₃ | | |
| b-5 | | -CSCH ₂ CH ₃ | | |
| b-6 | | -CSCH ₂ CH=CH ₂ | | |
| b-7 | | -CSCH ₂ C≡C-I | | |
| b-8 | | -CSOCH ₃ | | |
| b-9 | | -CSOCH ₂ CH ₃ | | |
| b-10 | | -CSOCH ₂ CH=CH ₂ | | |

Table I-b (Continued)


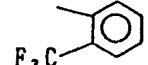

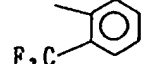

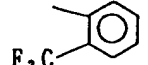

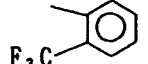

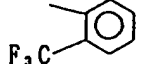


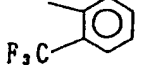


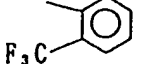


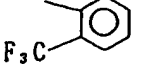


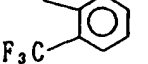


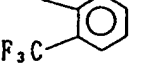


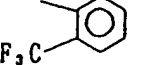


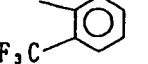
| Comp. No. | $(R_3)_n$ | R_1 | $(R_2)_1$ | Physical Property (Melting point) |
|-----------|---|---|--|-----------------------------------|
| b-11 |  | $-\text{CSOCH}_2\text{C}\equiv\text{Cl}$ |  | |
| b-12 |  | $-\text{CS}_2\text{CH}_3$ |  | $n_D^{38.2}$ 1.5888 |
| b-13 |  | $-\text{CS}_2\text{CH}_2\text{CH}_3$ |  | 106.2°C |
| b-14 |  | $-\text{CS}_2\text{CH}_2\text{CH}=\text{CH}_2$ |  | |
| b-15 |  | $-\text{CS}_2\text{CH}_2\text{C}\equiv\text{Cl}$ |  | |
| b-16 |  | $-\text{CS}-$  |  | |
| b-17 |  | $-\text{CSO}-$  |  | |
| b-18 |  | $-\text{CS}_2-$  |  | |
| b-19 |  | $-\text{CS}-$  |  | |
| b-20 |  | $-\text{CS}-$  |  | |
| b-21 |  | $-\text{CSO}-$  |  | Oily |
| b-22 |  | $-\text{CS}_2-$  |  | |

Table I-b (Continued)

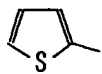

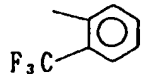
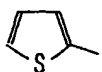

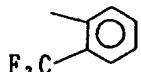
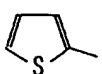

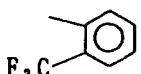
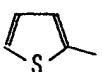

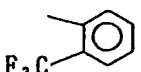
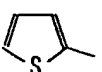

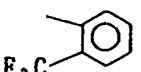
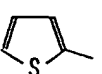

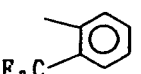
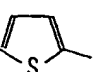

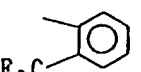
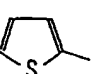

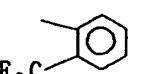
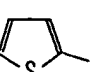

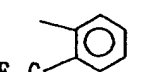
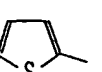

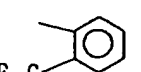
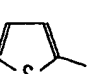

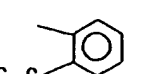
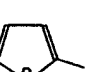

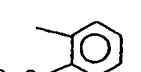
| Comp. No. | $(R_3)_n$ | R_1 | $(R_2)_1$ | Physical Property (Melting point) |
|-----------|---|--|--|-----------------------------------|
| b-23 |  | $-\text{CSCH}_2-$  |  | |
| b-24 |  | $-\text{CSOCH}_2-$  |  | |
| b-25 |  | $-\text{CS}_2\text{CH}_2-$  |  | |
| b-26 |  | $-\text{CS}_2-$  |  | |
| b-27 |  | $-\text{CS}_2-$  |  | |
| b-28 |  | $-\text{CS}_2-$  |  | |
| b-29 |  | $-\text{CS}_2-$  |  | |
| b-30 |  | $-\text{CS}_2-$  |  | |
| b-31 |  | $-\text{CS}_2-$  |  | |
| b-32 |  | $-\text{CS}_2-$  |  | |
| b-33 |  | $-\text{CS}_2-$  |  | |
| b-34 |  | $-\text{CS}_2-$  |  | |

Table I-b (Continued)

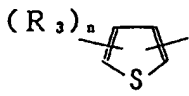
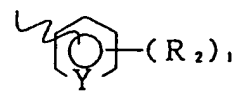
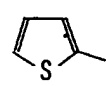
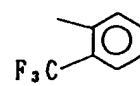
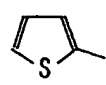
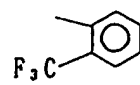
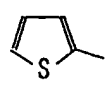
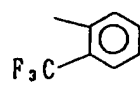
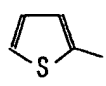
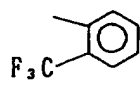
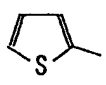
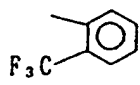
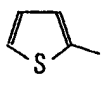

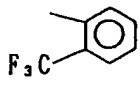
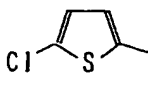
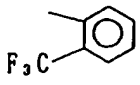
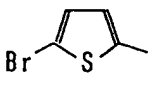
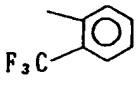
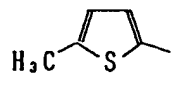
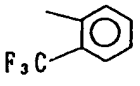
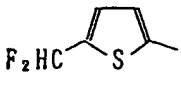
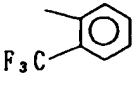
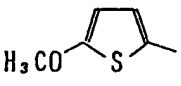
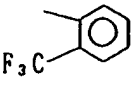
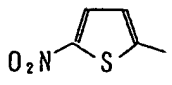

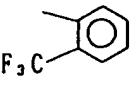
| Comp. No. | $(R_3)_n$  | R_1 |  $(R_2)_1$ | Physical Property (Melting point) |
|-----------|---|--|--|-----------------------------------|
| b-35 |  | $-\text{CS}_2-\text{N} \begin{array}{c} \diagup \diagdown \\ \text{N} \end{array} \text{N}$ |  | |
| b-36 |  | $-\text{COSCH}_3$ |  | |
| b-37 |  | $-\text{COSCH}_2\text{CH}_3$ |  | |
| b-38 |  | $-\text{COSCH}_2\text{CH}=\text{CH}_2$ |  | |
| b-39 |  | $-\text{COSCH}_2\text{C}\equiv\text{CI}$ |  | |
| b-40 |  | $-\text{COS}-$  |  | |
| b-41 |  | $-\text{CSOCH}_3$ |  | |
| b-42 |  | $-\text{CSOCH}_2\text{CH}_3$ |  | |
| b-43 |  | $-\text{CS}_2\text{CH}_3$ |  | |
| b-44 |  | $-\text{CS}_2\text{CH}_2\text{CH}_3$ |  | |
| b-45 |  | $-\text{CS}_2\text{CH}_2\text{CH}=\text{CH}_2$ |  | |
| b-46 |  | $-\text{CSO}-$  |  | |

Table I-b (Continued)

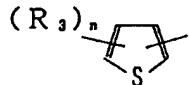
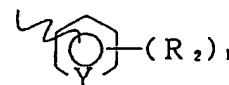
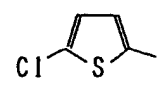
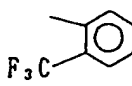
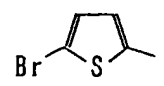
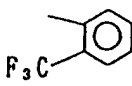
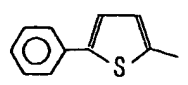
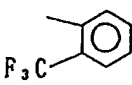
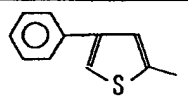
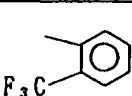
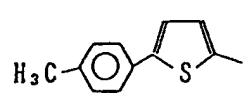

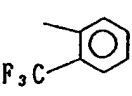
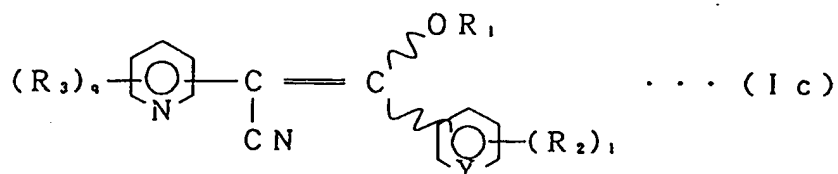
| Comp. No. | $(R_3)_n$  | R_1 |  $(R_2)_1$ | Physical Property (Melting point) |
|-----------|---|--|--|-----------------------------------|
| b-47 |  | $-\text{COSCH}_3$ |  | |
| b-48 |  | $-\text{COSCH}_2\text{CH}_3$ |  | |
| b-49 |  | $-\text{COSCH}_2\text{CH}=\text{CH}_2$ |  | |
| b-50 |  | $-\text{COSCH}_2\text{C}\equiv\text{CI}$ |  | |
| b-51 |  | $-\text{COS}$  |  | |

Table I-c




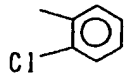

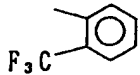

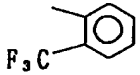

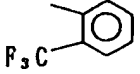

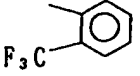

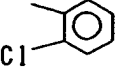

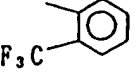

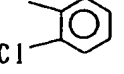

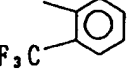

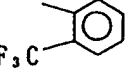
| Comp. No. | $(R_3)_n - \text{C}_5\text{H}_4\text{N}$ | R_1 | $\text{C}_6\text{H}_3\text{Y}(\text{R}_2)_1$ | Physical property (Melting point) |
|-----------|---|--|--|-----------------------------------|
| c-1 |  | $-\text{COCH}_3$ |  | 120~123°C |
| c-2 |  | $-\text{COCH}_3$ |  | |
| c-3 |  | $-\text{COCH}_2\text{CH}_3$ |  | |
| c-4 |  | $-\text{CO}(\text{CH}_2)_2\text{CH}_3$ |  | |
| c-5 |  | $-\text{COCH}(\text{CH}_3)_2$ |  | |
| c-6 |  | $-\text{COC}(\text{CH}_3)_3$ |  | 93~95°C |
| c-7 |  | $-\text{COC}(\text{CH}_3)_3$ |  | |
| c-8 |  | $-\text{CON}(\text{CH}_3)_2$ |  | oily |
| c-9 |  | $-\text{SO}_2\text{CH}_3$ |  | |
| c-10 |  | $-\text{SO}_2\text{CH}_2\text{CH}_3$ |  | |

Table I-c (Continued)

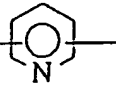


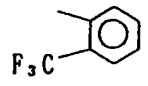
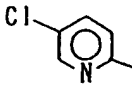
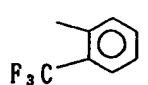
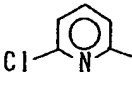
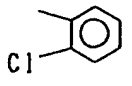
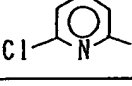
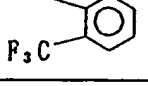
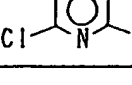
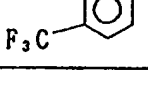
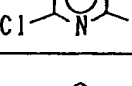
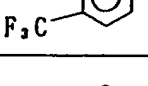
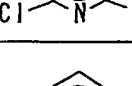
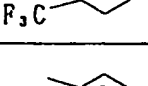
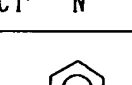
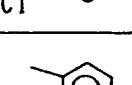
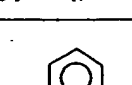
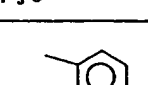
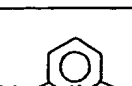
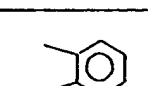
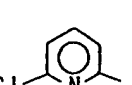
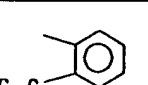


| Comp. No. | $(R_3)_n$  | R_1 |  $(R_2)_1$ | Physical Property (Melting point) |
|-----------|---|--|---|-----------------------------------|
| c-11 |  | $-\text{SO}_2(\text{CH}_2)_2\text{CH}_3$ |  | |
| c-12 |  | $-\text{COCH}_3$ |  | |
| c-13 |  | $-\text{COCH}_3$ |  | 101~102°C |
| c-14 |  | $-\text{COCH}_3$ |  | |
| c-15 |  | $-\text{COCH}_2\text{CH}_3$ |  | |
| c-16 |  | $-\text{CO}(\text{CH}_2)_2\text{CH}_3$ |  | |
| c-17 |  | $-\text{COCH}(\text{CH}_3)_2$ |  | |
| c-18 |  | $-\text{COC}(\text{CH}_3)_3$ |  | 139~140°C |
| c-19 |  | $-\text{COC}(\text{CH}_3)_3$ |  | |
| c-20 |  | $-\text{SO}_2\text{CH}_3$ |  | |
| c-21 |  | $-\text{SO}_2\text{CH}_2\text{CH}_3$ |  | |
| c-22 |  | $-\text{SO}_2(\text{CH}_2)_2\text{CH}_3$ |  | |

Table I-c (Continued)

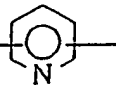

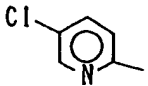
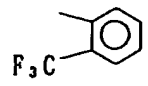
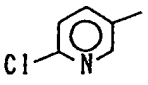
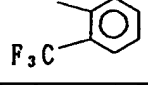
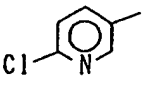
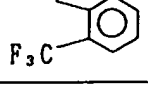
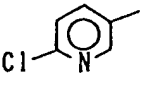
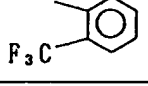
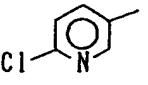
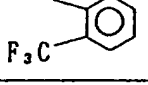
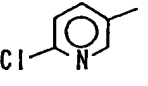
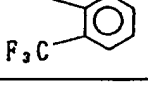
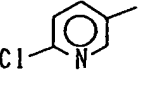
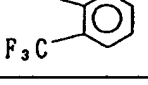
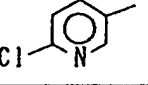
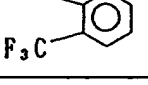
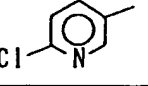
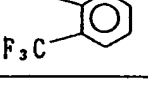
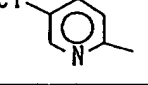
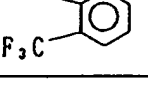
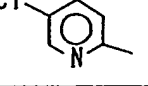
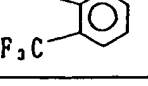
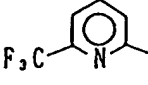
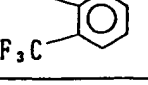
| Comp. No. | $(R_3)_n$  | R_1 |  $(R_2)_1$ | Physical Property (Melting point) |
|-----------|---|--|---|-----------------------------------|
| c-23 |  | $-\text{SO}_2\text{CH}_3$ |  | |
| c-24 |  | $-\text{COCH}_3$ |  | |
| c-25 |  | $-\text{COCH}_2\text{CH}_3$ |  | |
| c-26 |  | $-\text{CO}(\text{CH}_2)_2\text{CH}_3$ |  | |
| c-27 |  | $-\text{COCH}(\text{CH}_3)_2$ |  | |
| c-28 |  | $-\text{COC}(\text{CH}_3)_3$ |  | |
| c-29 |  | $-\text{SO}_2\text{CH}_3$ |  | |
| c-30 |  | $-\text{SO}_2\text{CH}_2\text{CH}_3$ |  | |
| c-31 |  | $-\text{SO}_2(\text{CH}_2)_2\text{CH}_3$ |  | |
| c-32 |  | $-\text{SO}_2\text{CH}_2\text{CH}_3$ |  | |
| c-33 |  | $-\text{SO}_2\text{N}(\text{CH}_3)_2$ |  | |
| c-34 |  | $-\text{COCH}_3$ |  | 72~73°C |

Table I-c (Continued)

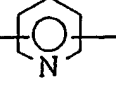

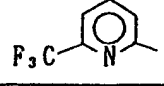
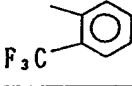
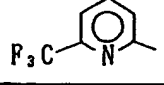
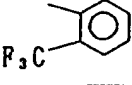
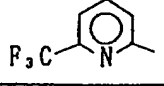
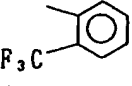
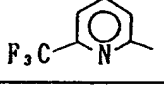
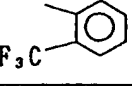
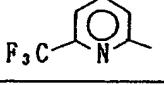
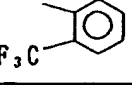
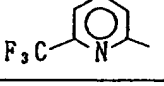
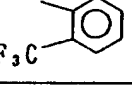
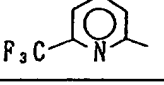
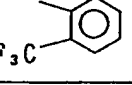
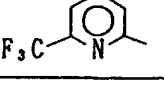
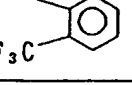
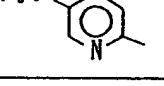
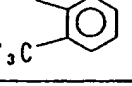
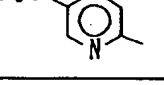
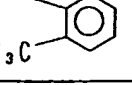
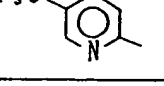
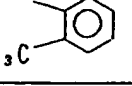
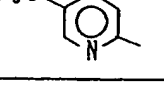
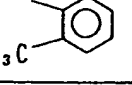
| Comp. No. | $(R_3)_4$  | R_1 |  $(R_2)_1$ | Physical Property (Melting point) |
|-----------|---|--|---|-----------------------------------|
| c-35 |  | $-\text{COCH}_2\text{CH}_3$ |  | |
| c-36 |  | $-\text{CO}(\text{CH}_2)_2\text{CH}_3$ |  | |
| c-37 |  | $-\text{COCH}(\text{CH}_3)_2$ |  | |
| c-38 |  | $-\text{COC}(\text{CH}_3)_3$ |  | |
| c-39 |  | $-\text{SO}_2\text{CH}_3$ |  | |
| c-40 |  | $-\text{SO}_2\text{CH}_2\text{CH}_3$ |  | |
| c-41 |  | $-\text{SO}_2(\text{CH}_2)_2\text{CH}_3$ |  | |
| c-42 |  | $-\text{SO}_2\text{N}(\text{CH}_3)_2$ |  | 121~ 123°C |
| c-43 |  | $-\text{SO}_2\text{N}(\text{CH}_3)_2$ |  | 205~ 207°C |
| c-44 |  | $-\text{COCH}_3$ |  | 198~ 200°C |
| c-45 |  | $-\text{COCH}_2\text{CH}_3$ |  | |
| c-46 |  | $-\text{CO}(\text{CH}_2)_2\text{CH}_3$ |  | |

Table I-c (Continued)

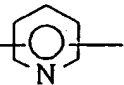

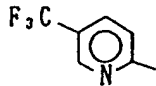
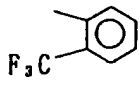
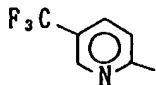
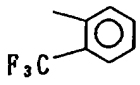
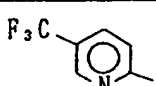
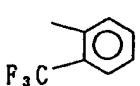
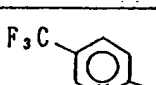
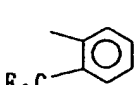
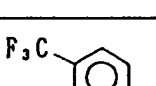
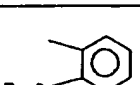
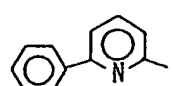
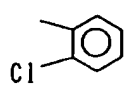
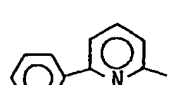
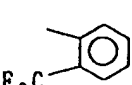
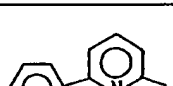
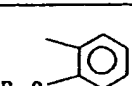
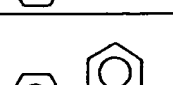
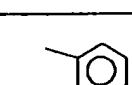
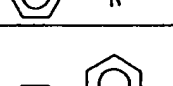
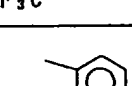
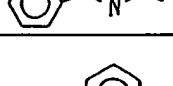
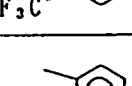
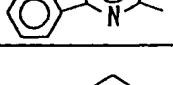
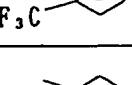
| Comp. No. | $(R_3)_n$  | R_1 |  $(R_2)_1$ | Physical Property (Melting point) |
|-----------|---|--|---|-----------------------------------|
| c-47 |  | $-\text{COCH}(\text{CH}_3)_2$ |  | |
| c-48 |  | $-\text{COC}(\text{CH}_3)_3$ |  | |
| c-49 |  | $-\text{SO}_2\text{CH}_3$ |  | |
| c-50 |  | $-\text{SO}_2\text{CH}_2\text{CH}_3$ |  | |
| c-51 |  | $-\text{SO}_2(\text{CH}_2)_2\text{CH}_3$ |  | |
| c-52 |  | $-\text{COCH}_3$ |  | |
| c-53 |  | $-\text{COCH}_3$ |  | |
| c-54 |  | $-\text{COCH}_2\text{CH}_3$ |  | |
| c-55 |  | $-\text{CO}(\text{CH}_2)_2\text{CH}_3$ |  | |
| c-56 |  | $-\text{COCH}(\text{CH}_3)_2$ |  | |
| c-57 |  | $-\text{COC}(\text{CH}_3)_3$ |  | |
| c-58 |  | $-\text{SO}_2\text{CH}_3$ |  | |

Table I-c (Continued)

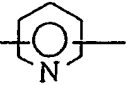

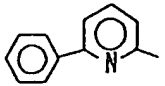
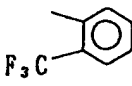
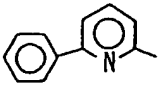
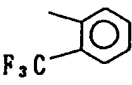
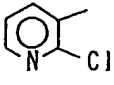


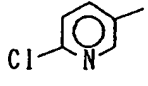

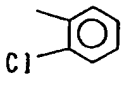
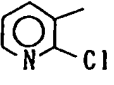


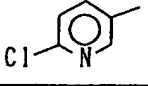


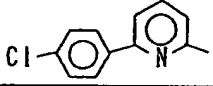
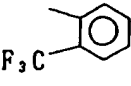
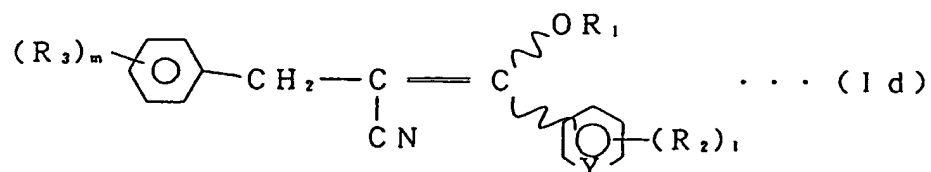
| Comp. No. | $(R_3)_4$  | R_1 |  $(R_2)_1$ | Physical Property (Melting point) |
|-----------|---|---|--|-----------------------------------|
| c-59 |  | $-\text{SO}_2\text{CH}_2\text{CH}_3$ |  | |
| c-60 |  | $-\text{SO}_2(\text{CH}_2)_2\text{CH}_3$ |  | |
| c-61 |  | $-\text{CO}-$  |  | Z-isomer 116~ 120°C |
| c-62 |  | $-\text{CO}-$  |  | Oily |
| c-63 |  | $-\text{CO}-$  |  | E-isomer 171~ 176°C |
| c-64 |  | $-\text{CO}-$  |  | 138~ 142°C |
| c-65 |  | $-\text{SO}_2\text{N}(\text{CH}_2\text{CH}_3)_2$ |  | |

Table I-d




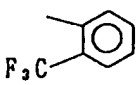

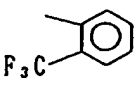

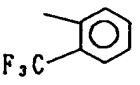

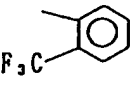

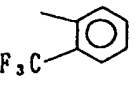

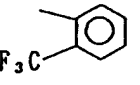

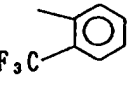

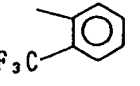

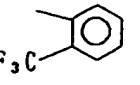

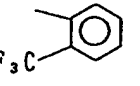
| Comp. No. | $(R_3)_m - \text{C}_6\text{H}_4 - \text{CH}_2 -$ | R_1 | $\text{C}_6\text{H}_4\text{---} (R_2)_1$ | Physical property (Melting point) |
|-----------|--|---|--|-----------------------------------|
| d-1 |  -CH ₂ - | -COCH ₃ |  | |
| d-2 |  -CH ₂ - | -CO ₂ CH ₃ |  | |
| d-3 |  -CH ₂ - | -CS ₂ CH ₃ |  | E-isomer n_D^{20} 1.5352 |
| d-4 |  -CH ₂ - | -CS ₂ CH ₃ |  | Z-isomer n_D^{20} 1.5651 |
| d-5 |  -CH ₂ - | -CS ₂ CH ₂ CH ₃ |  | |
| d-6 |  -CH ₂ - | -SO ₂ N(CH ₃) ₂ |  | |
| d-7 |  -CH ₂ - | -SO ₂ N(CH ₂ CH ₃) ₂ |  | |
| d-8 | Cl-  -CH ₂ - | -COCH ₃ |  | |
| d-9 | Cl-  -CH ₂ - | -CO ₂ CH ₃ |  | |
| d-10 | Cl-  -CH ₂ - | -CS ₂ CH ₃ |  | |

Table I-d (Continued)

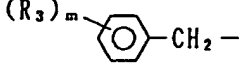
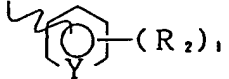
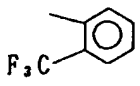
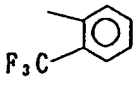
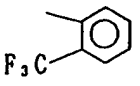
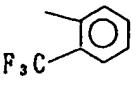
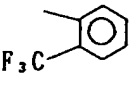
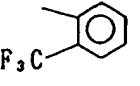
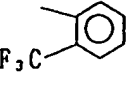
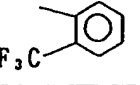
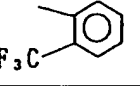
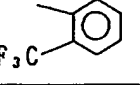
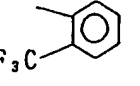
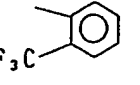
| Comp. No. | $(R_3)_m$  CH_2- | R_1 |  $(R_2)_1$ | Physical Property (Melting point) |
|-----------|--|--|--|-----------------------------------|
| d-11 | $\text{Cl}-\text{C}_6\text{H}_4-\text{CH}_2-$ | $-\text{CS}_2\text{CH}_2\text{CH}_3$ |  | |
| d-12 | $\text{Cl}-\text{C}_6\text{H}_4-\text{CH}_2-$ | $-\text{SO}_2\text{N}(\text{CH}_3)_2$ |  | |
| d-13 | $\text{Cl}-\text{C}_6\text{H}_4-\text{CH}_2-$ | $-\text{SO}_2\text{N}(\text{CH}_2\text{CH}_3)_2$ |  | |
| d-14 | $\text{Br}-\text{C}_6\text{H}_4-\text{CH}_2-$ | $-\text{COCH}_3$ |  | |
| d-15 | $\text{Br}-\text{C}_6\text{H}_4-\text{CH}_2-$ | $-\text{CO}_2\text{CH}_3$ |  | |
| d-16 | $\text{Br}-\text{C}_6\text{H}_4-\text{CH}_2-$ | $-\text{CS}_2\text{CH}_3$ |  | |
| d-17 | $\text{Br}-\text{C}_6\text{H}_4-\text{CH}_2-$ | $-\text{CS}_2\text{CH}_2\text{CH}_3$ |  | |
| d-18 | $\text{Br}-\text{C}_6\text{H}_4-\text{CH}_2-$ | $-\text{SO}_2\text{N}(\text{CH}_3)_2$ |  | |
| d-19 | $\text{Br}-\text{C}_6\text{H}_4-\text{CH}_2-$ | $-\text{SO}_2\text{N}(\text{CH}_2\text{CH}_3)_2$ |  | |
| d-20 | $\text{F}-\text{C}_6\text{H}_4-\text{CH}_2-$ | $-\text{COCH}_3$ |  | |
| d-21 | $\text{F}-\text{C}_6\text{H}_4-\text{CH}_2-$ | $-\text{CO}_2\text{CH}_3$ |  | |
| d-22 | $\text{F}-\text{C}_6\text{H}_4-\text{CH}_2-$ | $-\text{CS}_2\text{CH}_3$ |  | |

Table I-d (Continued)



























| Comp. No. | $(R_3)_m$  CH_2- | R_1 |  $(R_2)_1$ | Physical Property (Melting point) |
|-----------|--|--|---|-----------------------------------|
| d-23 |  CH_2- | $-\text{CS}_2\text{CH}_2\text{CH}_3$ |  | |
| d-24 |  CH_2- | $-\text{SO}_2\text{N}(\text{CH}_3)_2$ |  | |
| d-25 |  CH_2- | $-\text{SO}_2\text{N}(\text{CH}_2\text{CH}_3)_2$ |  | |
| d-26 |  CH_2- | $-\text{COCH}_3$ |  | |
| d-27 |  CH_2- | $-\text{CO}_2\text{CH}_3$ |  | |
| d-28 |  CH_2- | $-\text{CS}_2\text{CH}_3$ |  | |
| d-29 |  CH_2- | $-\text{CS}_2\text{CH}_2\text{CH}_3$ |  | |
| d-30 |  CH_2- | $-\text{SO}_2\text{N}(\text{CH}_3)_2$ |  | |
| d-31 |  CH_2- | $-\text{SO}_2\text{N}(\text{CH}_2\text{CH}_3)_2$ |  | |
| d-32 |  CH_2- | $-\text{COCH}_3$ |  | |
| d-33 |  CH_2- | $-\text{CO}_2\text{CH}_3$ |  | |
| d-34 |  CH_2- | $-\text{CS}_2\text{CH}_3$ |  | |

Table I-d (Continued)

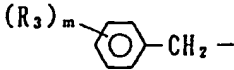
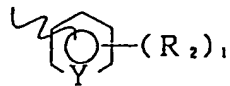
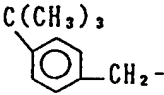
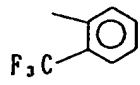
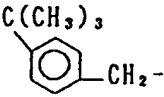
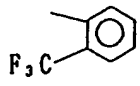
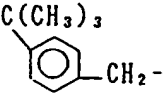
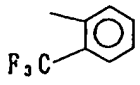
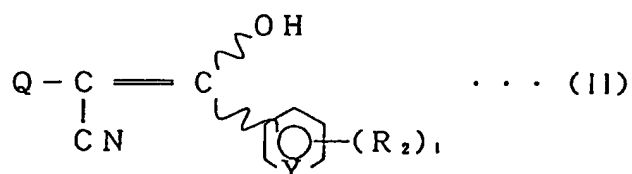
| Comp. No. | $(R_3)_m$  $-CH_2-$ | R_1 |  $(R_2)_1$ | Physical Property (Melting point) |
|-----------|--|----------------------|--|-----------------------------------|
| d-35 |  $-CH_2-$ | $-CS_2CH_2CH_3$ |  | |
| d-36 |  $-CH_2-$ | $-SO_2N(CH_3)_2$ |  | |
| d-37 |  $-CH_2-$ | $-SO_2N(CH_2CH_3)_2$ |  | |

Table 2



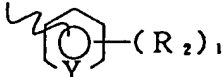

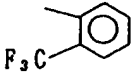
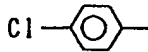
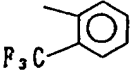
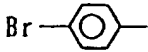
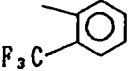
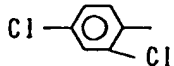
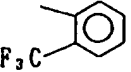
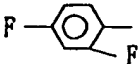
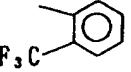
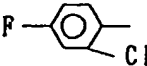
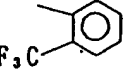
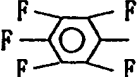
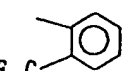
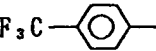
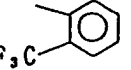
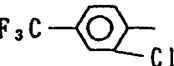
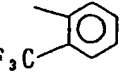
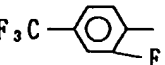
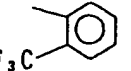
| Intermediate No. | Q |  | Physical property (Melting point) |
|------------------|---|---|-----------------------------------|
| 11-1 |  |  | 154~ 156°C |
| 11-2 |  |  | 146~ 148°C |
| 11-3 |  |  | 168~ 173°C |
| 11-4 |  |  | 182~ 183°C |
| 11-5 |  |  | |
| 11-6 |  |  | 120~ 130°C |
| 11-7 |  |  | |
| 11-8 |  |  | 164~ 167°C |
| 11-9 |  |  | |
| 11-10 |  |  | |

Table 2 (Continued)

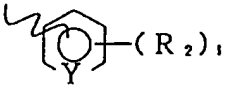
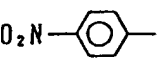
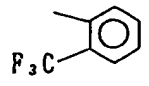
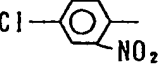
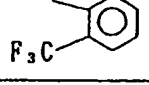
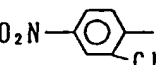
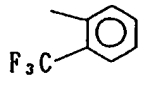
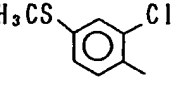
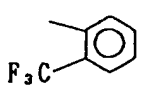
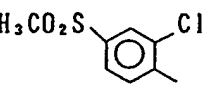
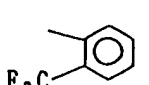
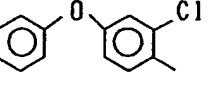
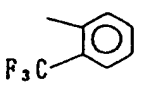
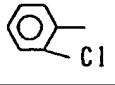
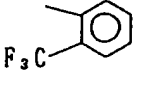
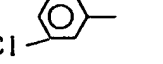
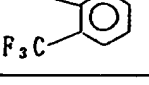
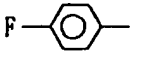
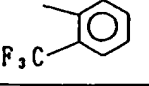
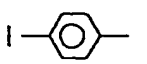
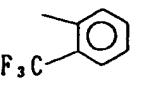
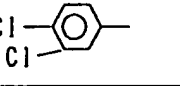
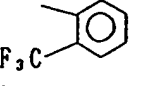
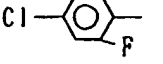
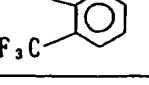
| Inter- mediate No. | Q |  | Physical property (Melting point) |
|--------------------------|---|---|--|
| 11-11 |  |  | 145~ 150°C |
| 11-12 |  |  | 175~ 177°C |
| 11-13 |  |  | |
| 11-14 |  |  | |
| 11-15 |  |  | |
| 11-16 |  |  | |
| 11-17 |  |  | 187~ 189°C |
| 11-18 |  |  | 118~ 121°C |
| 11-19 |  |  | 139~ 144°C |
| 11-20 |  |  | 170~ 180°C |
| 11-21 |  |  | 188~ 189°C |
| 11-22 |  |  | 176~ 180°C |

Table 2 (Continued)

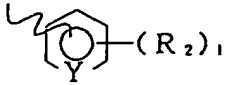
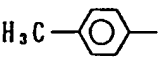
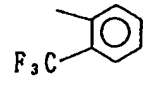
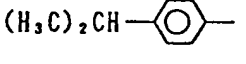
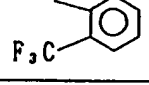
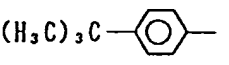
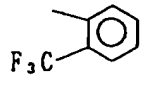
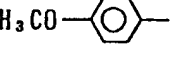
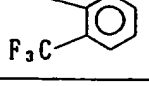
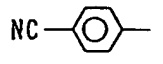
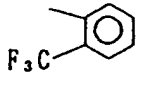
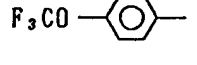
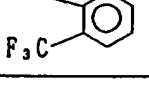
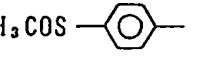
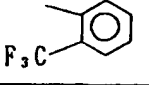
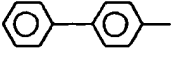
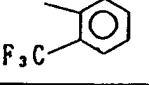
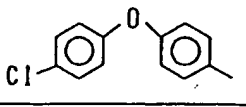
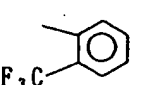
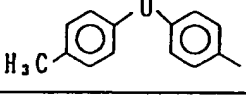
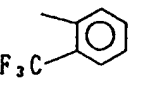
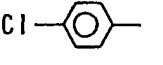
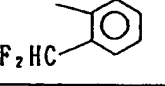
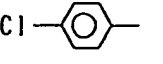
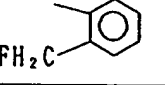
| Inter- mediate No. | Q |  | Physical property (Melting point) |
|--------------------------|---|---|--|
| 11-23 |  |  | 87~ 90°C |
| 11-24 |  |  | |
| 11-25 |  |  | 156~ 158°C |
| 11-26 |  |  | 90~ 92°C |
| 11-27 |  |  | |
| 11-28 |  |  | |
| 11-29 |  |  | |
| 11-30 |  |  | |
| 11-31 |  |  | |
| 11-32 |  |  | |
| 11-33 |  |  | |
| 11-34 |  |  | |

Table 2 (Continued)

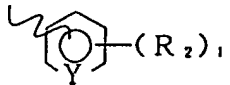
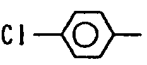
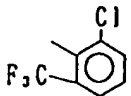
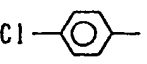
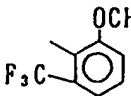
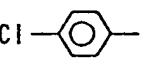
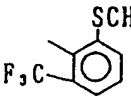
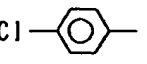
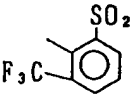
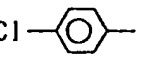
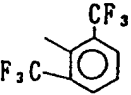
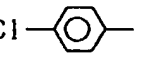
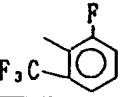
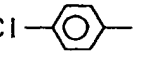
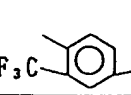
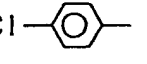
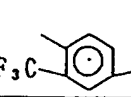
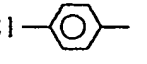
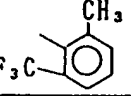
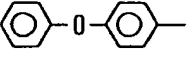
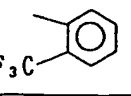
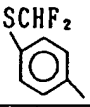
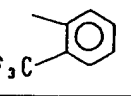
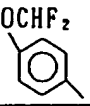
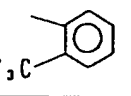
| Inter- mediate No. | Q |  (R ₂) ₁ | Physical property (Melting point) |
|--------------------------|---|--|--|
| II-35 |  |  | |
| II-36 |  |  | |
| II-37 |  |  | |
| II-38 |  |  | |
| II-39 |  |  | |
| II-40 |  |  | |
| II-41 |  |  | |
| II-42 |  |  | |
| II-43 |  |  | |
| II-44 |  |  | |
| II-45 |  |  | |
| II-46 |  |  | |

Table 2 (Continued)

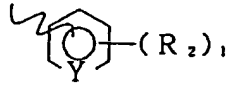
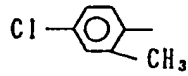
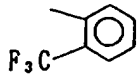
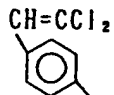
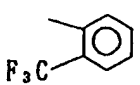
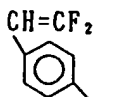
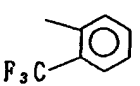
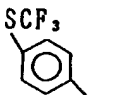
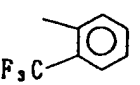
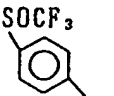
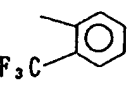
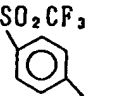
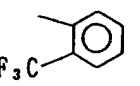
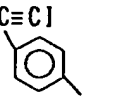
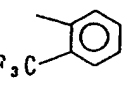
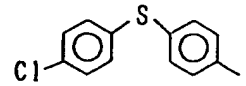
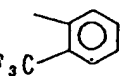
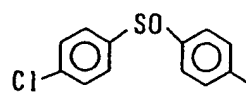
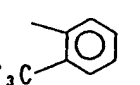
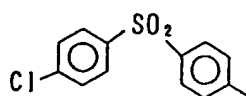
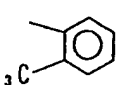
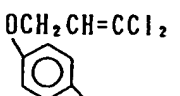
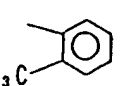
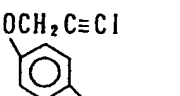
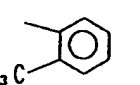
| Inter- mediate No. | Q |  (R ₂) ₁ | Physical property (Melting point) |
|--------------------------|---|--|--|
| II-47 |  |  | |
| II-48 |  |  | |
| II-49 |  |  | |
| II-50 |  |  | |
| II-51 |  |  | |
| II-52 |  |  | |
| II-53 |  |  | |
| II-54 |  |  | |
| II-55 |  |  | |
| II-56 |  |  | |
| II-57 |  |  | |
| II-58 |  |  | |

Table 2 (Continued)

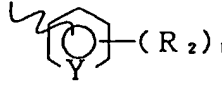
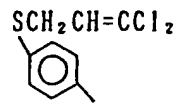
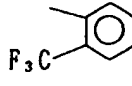
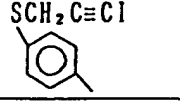
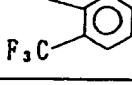
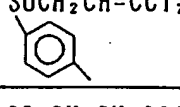
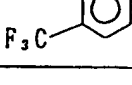
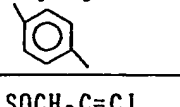
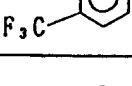
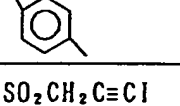
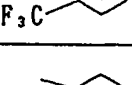
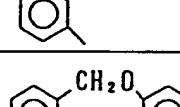
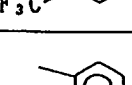
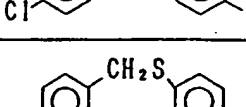
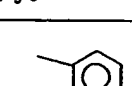
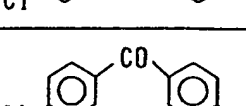
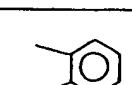
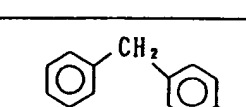
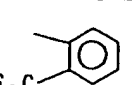
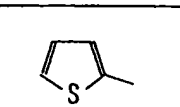
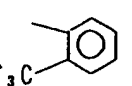
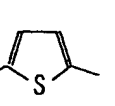
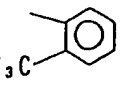


| Inter- mediate No. | Q |  | Physical property (Melting point) |
|--------------------------|---|---|--|
| 11-59 |  |  | |
| 11-60 |  |  | |
| 11-61 |  |  | |
| 11-62 |  |  | |
| 11-63 |  |  | |
| 11-64 |  |  | |
| 11-65 |  |  | |
| 11-66 |  |  | |
| 11-67 |  |  | |
| 11-68 |  |  | |
| 11-69 |  |  | 105~ 108°C |
| 11-70 |  |  | |

Table 2 (Continued)

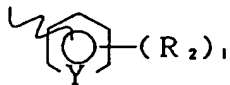
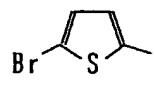
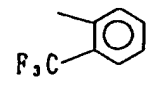
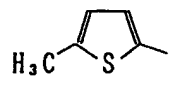
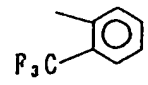
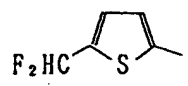
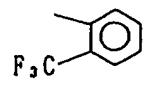
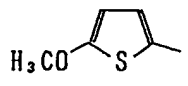
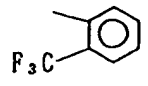
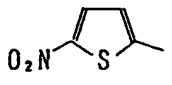
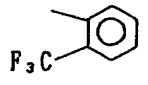
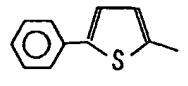
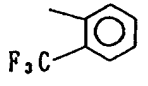
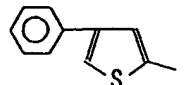
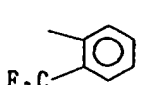
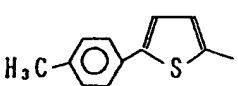
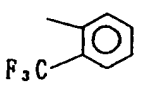
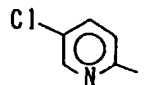
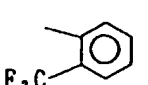
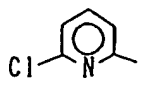
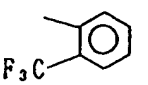
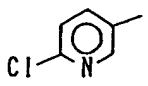
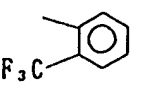
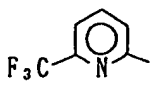
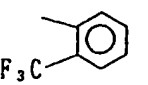
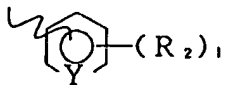
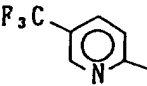
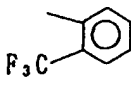
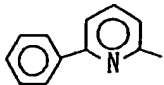
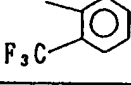
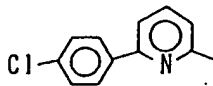
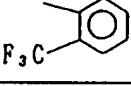
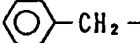
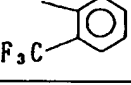
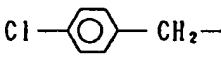
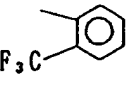
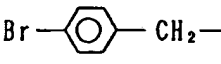
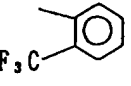
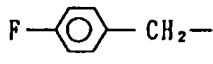
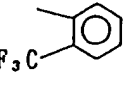
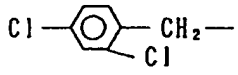
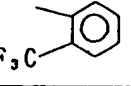
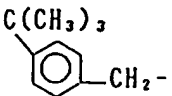
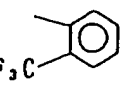
| Inter- mediate No. | Q |  (R ₂) ₁ | Physical property (Melting point) |
|--------------------------|---|--|--|
| 11-71 |  |  | |
| 11-72 |  |  | |
| 11-73 |  |  | |
| 11-74 |  |  | |
| 11-75 |  |  | |
| 11-76 |  |  | |
| 11-77 |  |  | |
| 11-78 |  |  | |
| 11-79 |  |  | |
| 11-80 |  |  | |
| 11-81 |  |  | |
| 11-82 |  |  | 115~ 119°C |

Table 2 (Continued)

| Inter- mediate No. | Q |  (R ₂) ₁ | Physical property (Melting point) |
|--------------------------|---|--|--|
| 11-83 |  |  | 206~ 213°C |
| 11-84 |  |  | |
| 11-85 |  |  | |
| 11-86 |  |  | |
| 11-87 |  |  | |
| 11-88 |  |  | |
| 11-89 |  |  | |
| 11-90 |  |  | |
| 11-91 |  |  | |

Now, Test Examples will be described.

TEST EXAMPLE 1

Miticidal test against adults of two-spotted spider mite
(Tetranychus urticae)

5 A miticidal solution was prepared to bring the
concentration of a compound of the present invention to
800 ppm. Kidney bean (Phaseolus vulgaris) seedling with
only one primary leaf left, was transplanted in a cup
(diameter: 8 cm, height: 7 cm) and 30 adults of two-
10 spotted spider mite (Tetranychus urticae) were inoculated
thereto. The adult mites were immersed together with the
kidney bean leaf in the above miticidal solution for
about 10 seconds, then dried in air and left in a
constant temperature chamber at 26°C with lightening. On
15 the second day after the treatment, dead adult mites were
counted, and the mortality was calculated by the
following equation.

$$\text{Mortality (\%)} = \frac{\text{Number of dead adult mites}}{\text{Number of treated adult mites}} \times 100$$

20

As a result, the mortality was at least 90% with
each of Compound Nos. a-6 to 7, a-10 to 14, a-20 to 25,
a-29, a-31, a-39, a-43, a-46 to 48, a-55, a-63, a-67, a-
72, a-77 to 78, a-80, a-83, a-97, a-99, a-153, a-156, a-
25 160 to 164, a-166 to 167, a-173, a-175 to 181, a-183 to
189, a-191, a-194 to 197, a-200 to 202, a-206 to 207, a-
209, a-211 to 212, a-214 to 215, a-218 to 221, a-223 to

224, a-227, a-230, a-240, a-244, a-245, a-250 to 251, a-
254 to 258, a-260 to 263, a-267, a-274, a-286, a-288, a-
290, a-298, a-300, a-303 to 308, a-310, a-316 to 319, a-
322, a-323, a-325, a-328 to 329, a-331, a-335, a-342, a-
5 359, a-360, a-362 to 363, a-365, a-367 to 368, a-371 to
373, a-375 to 376, a-381, a-382, a-384, a-386 to 388, a-
390, a-392, a-394 to 395, a-398, a-403, a-413 to 414, a-
417 to 418, a-425 to 426, a-428 to 431, a-434 to 435, a-
443, a-445, a-451 to 452, a-459 to 463, a-465 to 467, a-
10 469 to 472, a-474, a-475, a-573, a-574, a-637 to 641, a-
664 to 667, a-686, c-34, c-43 and c-44 and with
intermediate No. II-2.

TEST EXAMPLE 2

Ovicidal test against two-spotted spider mite

15 (Tetranychus urticae)

An ovicidal solution was prepared to bring the
concentration of a compound of the present invention to
800 ppm. Kidney bean (Phaseolus vulgaris) seedling with
only one primary leaf left, was transplanted in a cup
20 (diameter: 8 cm, height: 7 cm), and adults of two-spotted
spider mite (Tetranychus urticae) were inoculated thereto
and permitted to lay eggs for 24 hours, whereupon the
adult mites were removed. The eggs were dipped together
with the kidney bean leaf in the above ovicidal solution
25 for about 10 seconds, then dried in air and left in a
constant temperature chamber at 26°C with lightening. On
the 7th day after the treatment, hatching of the eggs was

investigated, and the ovicidal ratio was obtained by the following equation.

$$\text{Ovicidal ratio (\%)} = \frac{\text{Number of dead eggs}}{\text{Number of treated eggs}} \times 100$$

5

As a result, the ovicidal ratio was at least 90% with each of Compound Nos. a-10 to 14, a-20 to 25, a-29, a-31, a-38 to 39, a-43, a-46 to 48, a-55, a-63, a-67, a-70, a-72, a-77 to 78, a-80, a-83, a-97, a-99, a-150, a-156, a-160 to 164, a-166 to 168, a-173, a-175 to 181, a-183 to 189, a-191, a-194 to 197, a-200 to 202, a-204, a-206 to 207, a-209, a-211 to 212, a-214 to 215, a-218 to 221, a-223 to 224, a-227, a-230, a-233 to 234, a-240, a-244, a-245, a-250 to 251, a-254 to 258, a-260 to 262, a-267, a-274, a-282, a-286, a-288, a-298, a-300, a-303 to 308, a-310, a-316 to 319, a-322, a-323, a-325, a-328 to 329, a-331 to 333, a-335, a-337, a-342, a-348, a-359, a-360, a-362 to 363, a-365, a-367 to 368, a-371 to 372, a-375 to 376, a-381, a-382, a-384, a-386 to 388, a-390, a-394 to 395, a-399, a-403, a-407, a-413 to 414, a-417 to 418, a-425 to 426, a-428 to 431, a-434 to 435, a-443, a-445, a-451, a-452, a-456, a-459 to 463, a-465 to 467, a-470 to 472, a-474, a-475, a-573, a-574, a-637 to 641, a-662 to 667, a-686, c-34, c-43 and c-44.

25 TEST EXAMPLE 3

Insecticidal test against small brown planthopper
(Laodelphax striatellus)

Rice seedling was dipped for about 10 seconds in an insecticidal solution prepared to bring the concentration of a compound of the present invention to 800 ppm and then dried in air. Then, the seedling with its root wrapped with a wet absorbent cotton, was put into a test tube. Then, 10 larvae of small brown planthopper (Laodelphax striatellus) were released therein, and the test tube was covered with a gauze and left in a constant chamber at 26°C with lightening. On the 5th day after the release, dead larvae were counted, and the mortality was calculated by the following equation.

$$\text{Mortality (\%)} = \frac{\text{Number of dead insects}}{\text{Number of released insects}} \times 100$$

As a result, the mortality was at least 90% with each of Compound Nos. a-10 to 11, a-161, a-362, a-474, a-637, a-638 and c-34.

TEST EXAMPLE 4

Insecticidal test against green peach aphid (Myzus persicae)

An insecticidal solution was prepared to bring the concentration of a compound of the present invention to 800 pm. The petiole of each of eggplants with only one foliage leaf left (planted in a pot having a diameter of 8 cm and a height of 7 cm) was coated with a sticker, and about 2-3 apterous viviparous female of green peach aphid (Myzus persicae) were infested and incubated on the

foliage leaf of the eggplant. After two days from the infestation, the adult insects were removed, and the number of larvae was counted. Then, the foliage leaf of the eggplant infested with the larvae was dipped in the
5 above insecticidal solution for about 10 seconds, then dried in air and left in a constant temperature chamber at 26°C with lightening. On the 5th day after the treatment, dead insects were counted, and the mortality was calculated by the following equation:

10

$$\text{Mortality (\%)} = \frac{\text{Number of dead insects}}{\text{Number of treated insects}} \times 100$$

The insects released from the leaf were counted as dead insects.

15

As a result, the mortality was at least 90% with each of Compound Nos. a-10 to 11, a-160 to 162, a-637 and a-638.

TEST EXAMPLE 5

Test on preventive effect against tomato late blight

20

Tomato (cultivar: Ponderosa) was cultivated in a polyethylene pot having a diameter of 7.5 cm. When the tomato reached a four-leaf stage, it was sprayed with 10 ml of a solution having a predetermined concentration of a compound of the present invention through a spray gun.

25

After the solution was dried, the tomato plant was sprayed and inoculated with a zoosporangia suspension of fungi of late blight (Phytophthora infestans) and kept in

a constant-temperature chamber at 20°C.

Third to fourth day after the inoculation, the area of lesions was examined, and the control index was determined according to the following criteria for evaluation.

| | <u>Control index</u> | <u>Degree of disease outbreak</u> <u>(visual observation)</u> |
|----|----------------------|---|
| | 5 | No lesions are recognizable at all. |
| 10 | 4 | The area, number or length of lesions is less than 10% of that in the non-treated plot. |
| | 3 | The area, number or length of lesions is less than 40% of that in the non-treated plot. |
| | 2 | The area, number or length of lesions is less than 70% of that in the non-treated plot. |
| 15 | 1 | The area, number or length of lesions is 70% or more of that in the non-treated plot. |

As a result, Compound No. a-3 exhibited a control index of 5 at a concentration of 250 ppm.

20 TEST EXAMPLE 6

Test on preventive effect against wheat powdery mildew

Wheat (cultivar: Norin No. 61) was cultivated in a polyethylene pot having a diameter of 7.5 cm. When the wheat reached a 1.5 leaf stage, it was sprayed with 10 ml of a solution having a predetermined concentration of a compound of the present invention through a spray gun. After the solution was dried, the wheat was dusted and

inoculated with conidia of fungi of powdery mildew (Erysiphe graminis) and kept in a constant-temperature chamber at 20°C.

5 Eighth day after the inoculation, the area of lesions or the spore-formation area was examined, and the control index was determined according to the following criteria for evaluation.

| <u>Control index</u> | <u>Degree of disease outbreak</u> <u>(visual observation)</u> |
|----------------------|---|
| 10 | 5 No lesion or spore-formation is recognizable at all. |
| | 4 The area or number of lesions or the spore-formation area is less than 10% of that in the non-treated plot. |
| | 3 The area or number of lesions or the spore-formation area is less than 40% of that in the non-treated plot. |
| 15 | 2 The area or number of lesions or the spore-formation area is less than 70% of that in the non-treated plot. |
| | 1 The area or number of lesions or the spore-formation area is 70% or more of that in the non-treated plot. |

20 As a result, Compounds Nos. a-7, a-30, a-63, a-67, a-77 to 78, a-123 and a-234 exhibited a control index of 5 at a concentration of 500 pm, and Compounds Nos. a-3, a-38 to 39 and a-46 exhibited a control index of 5 or 4 at a concentration of 250 ppm.

25 TEST EXAMPLE 7

Test on preventive effect against oat crown rust

Oat (cultivar: Zenshin) was cultivated in a

polyethylene pot having a diameter of 7.5 cm. When the oat reached a 1.5 leaf stage, it was sprayed with 10 ml of a solution having a predetermined concentration of a compound of the present invention through a spray gun.

5 After the solution was dried, the oat was sprayed and inoculated with a spore suspension of fungi of crown rust (Puccinia coronata). Eighth day after the inoculation, the area of lesions or spore-formation area was examined and the control index was determined in the same manner
10 as in Test Example 6.

As a result, compound Nos. a-78, a-123 and a-166 exhibited a control index of 5 at a concentration of 500 ppm, and Compound No. a-3 exhibited a control index of 5 at a concentration of 250 ppm.

15 TEST EXAMPLE 8

Control test against green algae

Green algae preliminarily cultured for 7 days (① Selenastrum capricornutum or ② Chlorella vulgaris) were inoculated to a culture medium for algae containing a
20 solution prepared to bring the concentration of a compound of the present invention to 100 ppm, and left to stand for 8 days in a constant temperature chamber at 20°C with lighting, whereupon growth degree of the green algae was investigated, and the control index was
25 determined according to the following criteria for evaluation.

| <u>Control index</u> | <u>Growth degree (visual observation)</u> |
|----------------------|--|
| A | No growth of green algae is observed at all |
| B | Growth of green algae is slightly observed. |
| C | Growth of green algae is observed in the same degree as in the non-treated plot. |

As a result, Compound Nos. a-3, a-6 and a-70 exhibited a control index of A against green algae ① at a concentration of 100 ppm. Further, against green algae ②, Compound Nos. a-3, a-6, a-26 and a-39 exhibited a control index of A at a concentration of 100 ppm.

Now, formulation Examples will be described.

FORMULATION EXAMPLE 1

- | | |
|-----------------------------|--------------------|
| (a) Compound No. a-31 | 20 parts by weight |
| (b) Clay | 72 parts by weight |
| (c) Sodium lignin sulfonate | 8 parts by weight |

The above components are uniformly mixed to obtain a wettable powder.

FORMULATION EXAMPLE 2

- | | |
|-----------------------|--------------------|
| (a) Compound No. b-26 | 5 parts by weight |
| (b) Talc | 95 parts by weight |

The above components are uniformly mixed to obtain a dust.

FORMULATION EXAMPLE 3

- | | |
|----------------------------|--------------------|
| (a) Compound No. a-39 | 20 parts by weight |
| (b) N,N'-dimethylacetamide | 20 parts by weight |

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(c) Polyoxyethylenealkylphenyl

ether 10 parts by weight

(d) Xylene 50 parts by weight

The above components are uniformly mixed and
5 dissolved to obtain an emulsifiable concentrate.

FORMULATION EXAMPLE 4

(a) Clay 68 parts by weight

(b) Sodium lignin sulfonate 2 parts by weight

(c) Polyoxyethylenealkylaryl
10 sulfate 5 parts by weight

(d) Fine silica powder 25 parts by weight

A mixture of the above components is mixed with
compound No. b-31 in a weight ratio of 4:1 to obtain a
wetable powder.

15 FORMULATION EXAMPLE 5

(a) Compound No. b-35 50 parts by weight

(b) Oxylated polyalkylphenyl
phosphate-triethanolamine 2 parts by weight

(c) Silicone 0.2 part by weight

20 (d) Water 47.8 parts by weight

The above components are uniformly mixed and
pulverized to obtain a base liquid, and

(e) Sodium polycarboxylate 5 parts by weight

(f) Anhydrous sodium sulfate 42.8 parts by weight

25 are added, and the mixture is uniformly mixed and dried
to obtain water-dispersible granules.

FORMULATION EXAMPLE 6

- (a) Compound No. b-48 5 parts by weight
- (b) Polyoxyethyleneoctylphenyl
ether 1 part by weight
- 5 (c) Phosphoric acid ester of
polyoxyethylene 0.1 part by weight
- (d) Granular calcium carbonate 93.5 parts by weight

The above components (a) to (c) are preliminarily
uniformly mixed and diluted with a proper amount of
10 acetone, and then the mixture is sprayed onto the
component (d), and acetone is removed to obtain granules.

FORMULATION EXAMPLE 7

- (a) Compound No. a-47 2.5 parts by weight
- (b) N-methyl-2-pyrrolidone 2.5 parts by weight
- 15 (c) Soybean oil 95.0 parts by weight

The above components are uniformly mixed and
dissolved to obtain an ultra low volume formulation.

FORMULATION EXAMPLE 8

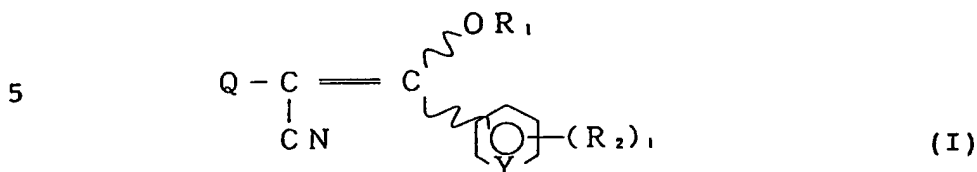
- (a) Compound No. a-55 5 parts by weight
- 20 (b) N,N'-dimethylacetamide 15 parts by weight
- (c) Polyoxyethylenealkylaryl
ether 10 parts by weigh
- (d) xylene 70 parts by weight

The above components are uniformly mixed to obtain an
25 emulsifiable concentrate.

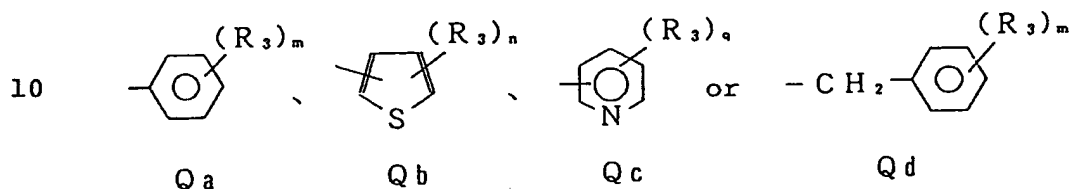
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CLAIMS

1. An acrylonitrile compound of the following formula
(I) or its salt:



wherein Q is



- Y is $=C(R_4)-$ or $=N-$, R_1 is alkyl, haloalkyl, alkoxyalkyl, alkylthioalkyl, alkenyl, haloalkenyl, alkynyl, haloalkynyl, $-C(=O)R_5$, $-C(=S)R_5$, $-S(O)_wR_5$ or $-CH_2R_9$, each of R_2 and R_3 is halogen, alkyl which may be substituted, alkenyl which may be substituted, alkynyl which may be substituted, alkoxy which may be substituted, alkenyloxy which may be substituted, alkynyloxy which may be substituted, alkylthio which may be substituted, alkylsulfinyl which may be substituted, alkylsulfonyl which may be substituted, alkenylthio which may be substituted, alkenylsulfinyl which may be substituted, alkenylsulfonyl which may be substituted, alkynylthio which may be substituted, alkynylsulfinyl which may be substituted, alkynylsulfonyl which may be substituted, nitro, cyano, phenyl which may be substituted, phenoxy

which may be substituted, phenylthio which may be substituted, phenylsulfinyl which may be substituted, phenylsulfonyl which may be substituted, benzyl which may be substituted, benzyloxy which may be substituted, benzylthio which may be substituted, or benzoyl which may be substituted, R_4 is hydrogen, halogen, alkyl or haloalkyl, R_5 is alkyl which may be substituted, alkenyl which may be substituted, alkynyl which may be substituted, alkoxy which may be substituted, alkenyloxy which may be substituted, alkynyloxy which may be substituted, alkylthio which may be substituted, alkenylthio which may be substituted, alkynylthio which may be substituted, cycloalkyl, cycloalkyloxy, cycloalkylthio, $-N(R_7)R_8$, phenyl which may be substituted, phenoxy which may be substituted, phenylthio which may be substituted, benzyl which may be substituted, benzyloxy which may be substituted, benzylthio which may be substituted, $-J$, $-O-J$ or $-S-J$, each of R_7 and R_8 is hydrogen, alkyl or alkoxy, R_9 is cyano, phenyl which may be substituted, phenoxy which may be substituted, phenylthio which may be substituted, phenylsulfinyl which may be substituted, phenylsulfonyl which may be substituted, benzyl which may be substituted, benzyloxy which may be substituted, benzylthio which may be substituted, benzoyl which may be substituted, $-J$, $-C(=O)R_{10}$, $-C(=S)R_{10}$, $-S(O)_wR_{10}$ or trimethylsilyl, R_{10} is alkyl or alkoxy, J is a 5- or

6-membered heterocyclic group containing from 1 to 4 hetero atoms of at least one type selected from the group consisting of O, S and N (the heterocyclic group may be substituted), l is from 1 to 4, m is from 0 to 5, n is from 0 to 3, q is from 0 to 4, w is from 0 to 2, when l is 2 or more, a plurality of R_2 may be the same or different, when each of m, n and q is 2 or more, a plurality of R_3 may be the same or different, provided that the following compounds are excluded (1) a compound wherein Q is Qb, Y is $=C(R_4)-$, and R_1 is alkyl, haloalkyl, alkoxyalkyl, alkylthioalkyl, alkenyl, haloalkenyl, alkynyl, haloalkynyl, $-S(O)_wR_5$ or $-CH_2R_9$, (2) a compound wherein Q is Qb, Y is $=C(R_4)-$, R_1 is $-C(=O)R_5$, and R_5 is alkyl which may be substituted, alkenyl which may be substituted, alkynyl which may be substituted, alkoxy which may be substituted, alkenyloxy which may be substituted, alkynyloxy which may be substituted, cycloalkyl, cycloalkyloxy, $-N(R_7)R_8$, phenyl which may be substituted, phenoxy which may be substituted, phenylthio which may be substituted, benzyl which may be substituted, benzyloxy which may be substituted, benzylthio which may be substituted, $-J$, $-O-J$ or $-S-J$, (3) a compound wherein Q is Qb, Y is $=C(R_4)-$, R_1 is $-C(=S)R_5$, and R_5 is $-N(R_7)R_8$, (4) a compound wherein Q is Qb or Qc, Y is $=N-$, R_1 is alkyl or $-C(=O)R_5$, and R_5 is alkyl, (5) 3-(4-chlorophenyl)-2-phenyl-3-ethoxyacrylonitrile, (6) 2-(3,5-

dimethoxyphenyl)-3-(2-methoxy-4-methylphenyl)-3-acetoxyacrylonitrile, and (7) 2-(3,5-dimethoxyphenyl)-3-(2,6-dimethoxy-4-methylphenyl)-3-acetoxyacrylonitrile.

2. The acrylonitrile compound or its salt according to

- 5 Claim 1, wherein the substituent for the alkyl which may be substituted, the alkenyl which may be substituted, the alkynyl which may be substituted, the alkoxy which may be substituted, the alkenyloxy which may be substituted, the alkynyloxy which may be substituted, the alkylthio which
- 10 may be substituted, the alkylsulfinyl which may be substituted, the alkylsulfonyl which may be substituted, the alkenylthio which may be substituted, the alkenylsulfinyl which may be substituted, the alkenylsulfonyl which may be substituted, the alkynylthio
- 15 which may be substituted, the alkynylsulfinyl which may be substituted and the alkynylsulfonyl which may be substituted for each of R_2 and R_3 , or the substituent for the alkyl which may be substituted, the alkenyl which may be substituted, the alkynyl which may be substituted, the
- 20 alkoxy which may be substituted, the alkenyloxy which may be substituted, the alkynyloxy which may be substituted, the alkylthio which may be substituted, the alkenylthio which may be substituted, and the alkynylthio which may be substituted for R_5 , is halogen, alkoxy, haloalkoxy,
- 25 alkoxycarbonyl, alkylthio, alkylsulfinyl, alkylsulfonyl, haloalkylthio, haloalkylsulfinyl, haloalkylsulfonyl, amino, monoalkylamino, dialkylamino, nitro or cyano, the

substituent for the phenyl which may be substituted, the phenoxy which may be substituted, the phenylthio which may be substituted, the phenylsulfinyl which may be substituted, the phenylsulfonyl which may be substituted, the benzyl which may be substituted, the benzyloxy which may be substituted, the benzylthio which may be substituted, and the benzoyl which may be substituted for each of R_2 and R_3 , the substituent for the phenyl which may be substituted, the phenoxy which may be substituted, the phenylthio which may be substituted, the benzyl which may be substituted, the benzyloxy which may be substituted and the benzylthio which may be substituted for R_5 , the substituent for the phenyl which may be substituted, the phenoxy which may be substituted, the phenylthio which may be substituted, the phenylsulfinyl which may be substituted, the phenylsulfonyl which may be substituted, the benzyl which may be substituted, the benzyloxy which may be substituted, the benzylthio which may be substituted, and the benzoyl which may be substituted for R_9 , or the substituent for the heterocyclic group for J, is halogen, alkyl, haloalkyl, alkoxy, haloalkoxy, nitro, cyano, $-S(O)_wR_6$, amino, monoalkylamino or dialkylamino, R_6 is alkyl or haloalkyl, and w is from 0 to 2.

3. The acrylonitrile compound or its salt according to Claim 1, wherein the heterocyclic group for J is furyl, thienyl, pyrrolyl, pyrazolyl, imidazolyl, triazolyl,

tetrazolyl, oxazolyl, isoxazolyl, thiazolyl, isothiazolyl, pyridyl, pyrimidinyl, 1-pyrrolidinyl, 1-piperidinyl or 4-morpholino.

4. The acrylonitrile compound or its salt according to
5 Claim 1, wherein Q is Qa, Qb or Qc, and each of R₂ and R₃ is halogen, alkyl, haloalkyl, alkoxy, haloalkoxy, alkylthio, alkylsulfinyl, alkylsulfonyl, nitro, cyano, phenyl which may be substituted by M₁, or phenoxy which may be substituted by M₁, R₅ is alkyl, haloalkyl,
10 alkoxyalkyl, alkylthioalkyl, aminoalkyl, monoalkylaminoalkyl, dialkylaminoalkyl, alkenyl, haloalkenyl, alkynyl, haloalkynyl, alkoxy, haloalkoxy, alkylthio, haloalkylthio, alkoxycarbonylalkylthio, alkenylthio, haloalkenylthio, alkynylthio,
15 haloalkynylthio, cycloalkyl, cycloalkylthio, -N(R₇)R₈, phenyl which may be substituted by M₁, phenoxy which may be substituted by M₁, phenylthio which may be substituted by M₁, benzyl which may be substituted by M₁, benzylthio which may be substituted by M₁, pyridyl which may be
20 substituted by M₁, 1-pyrrolidinyl, 1-piperidinyl, 4-morpholino, pyridyloxy which may be substituted by M₁, or pyridylthio which may be substituted by M₁, R₉ is cyano, phenyl which may be substituted by M₁, benzyloxy which may be substituted by M₁, benzoyl which may be
25 substituted by M₁, pyridyl which may be substituted by M₁, -C(=O)R₁₀, -S(O)_wR₁₀ or trimethylsilyl, M₁ is halogen, alkyl, haloalkyl, alkoxy, haloalkoxy, nitro, cyano,

$-S(O)_w R_6$, amino, monoalkylamino or dialkylamino, and R_6 is alkyl or haloalkyl.

5. The acrylonitrile compound or its salt according to Claim 1, wherein Q is Qa, Qb or Qc, each of R_2 and R_3 is
5 halogen, alkyl, haloalkyl, alkoxy, haloalkoxy, alkylthio, alkylsulfinyl, alkylsulfonyl, nitro, cyano, phenyl which may be substituted by M_2 , or phenoxy which may be substituted by M_2 , R_5 is alkyl, haloalkyl, alkoxyalkyl, alkenyl, haloalkenyl, alkynyl, haloalkynyl, alkoxy,
10 haloalkoxy, alkylthio, haloalkylthio, alkoxycarbonylalkylthio, alkenylthio, haloalkenylthio, alkynylthio, haloalkynylthio, cycloalkyl, cycloalkylthio, $-N(R_7)R_8$, phenyl which may be substituted by M_2 , phenoxy which may be substituted by M_2 , phenylthio which may be
15 substituted by M_2 , benzyl which may be substituted by M_2 , benzylthio which may be substituted by M_2 , pyridyl which may be substituted by M_2 , 1-pyrrolidinyl, 1-piperidinyl or 4-morpholino, each of R_7 and R_8 is hydrogen or alkyl, R_9 is cyano, phenyl which may be substituted by M_2 ,
20 benzyloxy which may be substituted by M_2 , benzoyl which may be substituted by M_2 , pyridyl which may be substituted by M_2 , $-C(=O)R_{10}$, $-S(O)_w R_{10}$ or trimethylsilyl, M_2 is halogen, alkyl, haloalkyl, alkoxy, haloalkoxy, nitro, cyano or $-S(O)_w R_6$, and R_6 is alkyl.

25 6. The acrylonitrile compound or its salt according to Claim 5, wherein Q is Qa or Qb.

7. The acrylonitrile compound or its salt according to

Claim 6, wherein Q is Qa.

8. The acrylonitrile compound or its salt according to Claim 1, wherein Q is Qa or Qb, Y is $=C(R_4)-$, and R_4 is hydrogen.

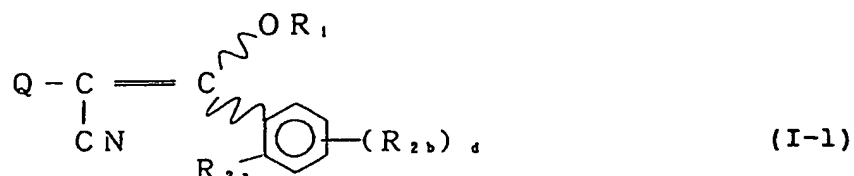
5 9. The acrylonitrile compound or its salt according to Claim 8, wherein Q is Qa.

10. The acrylonitrile compound or its salt according to Claim 8 or 9, wherein R_2 is halogen, alkyl or haloalkyl, and l is from 1 to 3.

10 11. The acrylonitrile compound or its salt according to Claim 8 or 9, wherein R_1 is alkoxyalkyl, $-C(=O)R_5$, $-C(=S)R_5$, $-S(O)_wR_5$ or $-CH_2R_9$, R_2 is halogen, alkyl or haloalkyl, R_3 is halogen or alkyl, R_5 is alkyl, haloalkyl, alkoxyalkyl, alkoxy, haloalkoxy, alkylthio, haloalkylthio, alkoxycarbonylalkylthio, alkenylthio, 15 $-N(R_7)R_8$, phenyl which may be substituted by M_3 , phenoxy which may be substituted by M_3 , phenylthio which may be substituted by M_3 , benzyl which may be substituted by M_3 , pyridyl which may be substituted by M_3 , 1-pyrrolidinyl or 20 4-morpholino, each of R_7 and R_8 is hydrogen or alkyl, R_9 is phenyl, M_3 is halogen, alkyl or alkoxy, l is from 1 to 3, m is from 0 to 3, n is from 0 to 1, and w is from 1 to 2.

12. The acrylonitrile compound or its salt according to Claim 1, wherein the formula (I) is the formula (I-1):

25



5 wherein Q is Q_a or Q_b, R_{2a} is haloalkyl, R_{2b} is halogen,
alkyl or haloalkyl, d is from 0 to 2, m is from 0 to 3,
and n is from 0 to 1.

13. The acrylonitrile compound or its salt according to Claim 12, wherein Q is Qa.

10 14. The acrylonitrile compound or its salt according to
Claim 12, wherein d is 0.

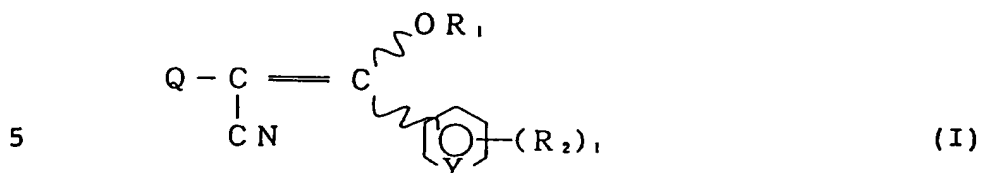
15. The acrylonitrile compound or its salt according to Claim 13, wherein d is 0.

16. The acrylonitrile compound or its salt according to
15 Claim 12, 13, 14 or 15, wherein R₁ is alkoxyalkyl,

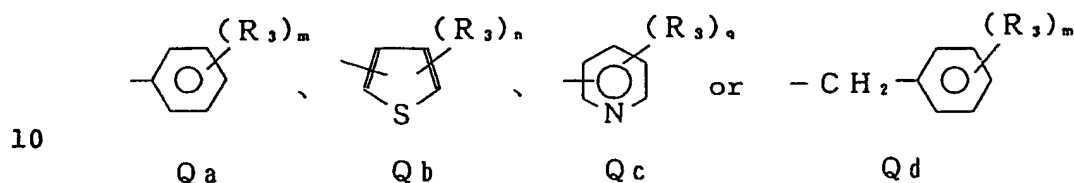
-C(=O)R₅, -C(=S)R₅, -S(O)_wR₅ or -CH₂R₉, R₂ is halogen, alkyl or haloalkyl, R₃ is halogen or alkyl, R₅ is alkyl, haloalkyl, alkoxyalkyl, alkoxy, haloalkoxy, alkylthio, haloalkylthio, alkoxycarbonylalkylthio, alkenylthio,

20 $-N(R_7)R_8$, phenyl which may be substituted by M_3 , phenoxy
which may be substituted by M_3 , phenylthio which may be
substituted by M_3 , benzyl which may be substituted by M_3 ,
pyridyl which may be substituted by M_3 , 1-pyrrolidinyl or
4-morpholino, each of R_7 and R_8 is hydrogen or alkyl, R_9
25 is phenyl, M_3 is halogen, alkyl or alkoxy, l is from 1 to
3, m is from 0 to 3, n is from 0 to 1, and w is from 1 to
2.

17. A process for producing an acrylonitrile compound of the following formula (I) or its salt:



wherein Q is

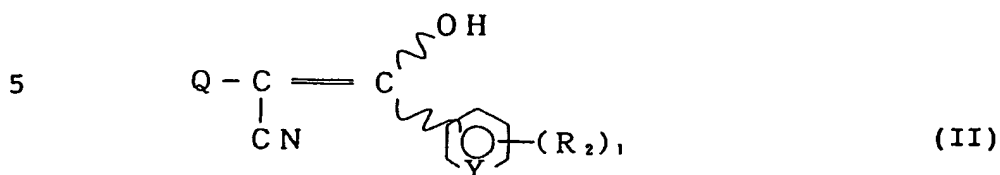


Y is =C(R₄)- or =N-, R₁ is alkyl, haloalkyl, alkoxyalkyl, alkylthioalkyl, alkenyl, haloalkenyl, alkynyl, haloalkynyl, -C(=O)R₅, -C(=S)R₅, -S(O)_vR₅ or -CH₂R₉, each of R₂ and R₃ is halogen, alkyl which may be substituted, alkenyl which may be substituted, alkynyl which may be substituted, alkoxy which may be substituted, alkenyloxy which may be substituted, alkynyloxy which may be substituted, alkylthio which may be substituted, alkylsulfinyl which may be substituted, alkylsulfonyl which may be substituted, alkenylthio which may be substituted, alkenylsulfinyl which may be substituted, alkenylsulfonyl which may be substituted, alkynylthio which may be substituted, alkynylsulfinyl which may be substituted, alkynylsulfonyl which may be substituted, nitro, cyano, phenyl which may be substituted, phenoxy which may be substituted, phenylthio which may be

substituted, phenylsulfinyl which may be substituted,
phenylsulfonyl which may be substituted, benzyl which may
be substituted, benzyloxy which may be substituted,
benzylthio which may be substituted, or benzoyl which may
5 be substituted, R_4 is hydrogen, halogen, alkyl or
haloalkyl, R_5 is alkyl which may be substituted, alkenyl
which may be substituted, alkynyl which may be
substituted, alkoxy which may be substituted, alkenyloxy
which may be substituted, alkynyloxy which may be
10 substituted, alkylthio which may be substituted,
alkenylthio which may be substituted, alkynylthio which
may be substituted, cycloalkyl, cycloalkyloxy,
cycloalkylthio, $-N(R_7)R_8$, phenyl which may be
substituted, phenoxy which may be substituted, phenylthio
15 which may be substituted, benzyl which may be
substituted, benzyloxy which may be substituted,
benzylthio which may be substituted, $-J$, $-O-J$ or $-S-J$,
each of R_7 and R_8 is hydrogen, alkyl or alkoxy, R_9 is
cyano, phenyl which may be substituted, phenoxy which may
20 be substituted, phenylthio which may be substituted,
phenylsulfinyl which may be substituted, phenylsulfonyl
which may be substituted, benzyl which may be
substituted, benzyloxy which may be substituted,
benzylthio which may be substituted, benzoyl which may be
25 substituted, $-J$, $-C(=O)R_{10}$, $-C(=S)R_{10}$, $-S(O)_wR_{10}$ or
trimethylsilyl, R_{10} is alkyl or alkoxy, J is a 5- or
6-membered heterocyclic group containing from 1 to 4

hetero atoms of at least one type selected from the group consisting of O, S and N (the heterocyclic group may be substituted), l is from 1 to 4, m is from 0 to 5, n is from 0 to 3, q is from 0 to 4, w is from 0 to 2, when l is 2 or more, a plurality of R_2 may be the same or different, when each of m, n and q is 2 or more, a plurality of R_3 may be the same or different, provided that the following compounds are excluded (1) a compound wherein Q is Qb, Y is $=C(R_4)-$, and R_1 is alkyl, haloalkyl, alkoxyalkyl, alkylthioalkyl, alkenyl, haloalkenyl, alkynyl, haloalkynyl, $-S(O)_wR_5$ or $-CH_2R_9$, (2) a compound wherein Q is Qb, Y is $=C(R_4)-$, R_1 is $-C(=O)R_5$, and R_5 is alkyl which may be substituted, alkenyl which may be substituted, alkynyl which may be substituted, alkoxy which may be substituted, alkenyloxy which may be substituted, alkynyloxy which may be substituted, cycloalkyl, cycloalkyloxy, $-N(R_7)R_8$, phenyl which may be substituted, phenoxy which may be substituted, phenylthio which may be substituted, benzyl which may be substituted, benzyloxy which may be substituted, benzylthio which may be substituted, $-J$, $-O-J$ or $-S-J$, (3) a compound wherein Q is Qb, Y is $=C(R_4)-$, R_1 is $-C(=S)R_5$, and R_5 is $-N(R_7)R_8$, (4) a compound wherein Q is Qb or Qc, Y is $=N-$, R_1 is alkyl or $-C(=O)R_5$, and R_5 is alkyl, (5) 3-(4-chlorophenyl)-2-phenyl-3-ethoxyacrylonitrile, (6) 2-(3,5-dimethoxyphenyl)-3-(2-methoxy-4-methylphenyl)-3-

acetoxyacrylonitrile, and (7) 2-(3,5-dimethoxyphenyl)-3-(2,6-dimethoxy-4-methylphenyl)-3-acetoxyacrylonitrile, which comprises reacting a compound of the formula (II):



wherein Q, Y, R₂ and l are as defined above, with a compound of the formula (III):



wherein R₁ is as defined above, and X is halogen.

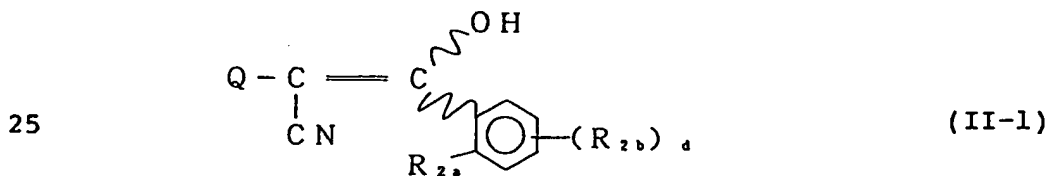
18. A pesticide containing the acrylonitrile compound or its salt as defined in Claim 1, as an active ingredient.

19. An insecticide, miticide or nematocide containing the
15 acrylonitrile compound or its salt as defined in Claim 1,
as an active ingredient.

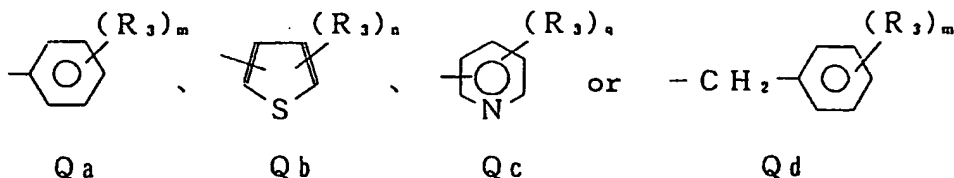
20. A fungicide containing the acrylonitrile compound or its salt as defined in Claim 1, as an active ingredient.

21. A marine antifouling agent containing the
20 acrylonitrile compound or its salt as defined in Claim 1,
as an active ingredient.

22. A compound of the formula (II-1) or its salt:



wherein Q is



- 5 R_{2a} is haloalkyl, R_{2b} is halogen, alkyl or haloalkyl, R_3 is halogen, alkyl which may be substituted, alkenyl which may be substituted, alkynyl which may be substituted, alkoxy which may be substituted, alkenyloxy which may be substituted, alkynyloxy which may be substituted,
- 10 alkylthio which may be substituted, alkylsulfinyl which may be substituted, alkylsulfonyl which may be substituted, alkenylthio which may be substituted, alkenylsulfinyl which may be substituted, alkenylsulfonyl which may be substituted, alkynylthio which may be substituted,
- 15 substituted, alkynylsulfinyl which may be substituted, alkynylsulfonyl which may be substituted, nitro, cyano, phenyl which may be substituted, phenoxy which may be substituted, phenylthio which may be substituted, phenylsulfinyl which may be substituted, phenylsulfonyl
- 20 which may be substituted, benzyl which may be substituted, benzyloxy which may be substituted, benzylthio which may be substituted, or benzoyl which may be substituted, d is from 0 to 2, m is from 0 to 5, n is from 0 to 3, q is from 0 to 4, when d is 2, two R_{2b} may
- 25 be the same or different, when each of m, n and q is 2 or more, a plurality of R_3 may be the same or different, when Q is Qc, (1) q is not 0, or (2) R_3 is not alkyl.

23. The compound or its salt according to Claim 22,
wherein Q is Qa or Qb.

24. The compound or its salt according to Claim 22,
wherein Q is Qa.

5 25. The compound or its salt according to Claim 22, 23 or
24, wherein d is 0.

26. A method for controlling a pest, which comprises
applying the compound as claimed in Claim 1 or 22 as an
active ingredient to the pest.

INTERNATIONAL SEARCH REPORT

In. ational Application No
PCT/JP 98/00584

A. CLASSIFICATION OF SUBJECT MATTER

IPC 6 C07C255/38 A01N37/34 C07C255/37 C07C255/36 C07C309/65
A01N43/40 C07C307/02 C07D213/57 C07D295/22

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 C07C A01N C07D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|----------|--|-----------------------|
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| A | PATENT ABSTRACTS OF JAPAN vol. 009, no. 119 (C-282), 23 May 1985 & JP 60 011401 A (SHOWA DENKO KK), 21 January 1985, cited in the application see abstract --- | 1-26 |
| A | EP 0 104 690 A (SHELL INT RESEARCH) 4 April 1984 cited in the application see claims; examples --- | 1-26 |
| -/- | | |

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents :

- "A" document defining the general state of the art which is not considered to be of particular relevance
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- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

- "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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- "&" document member of the same patent family

Date of the actual completion of the international search

15 July 1998

Date of mailing of the international search report

24/07/1998

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INTERNATIONAL SEARCH REPORT

Int .tional Application No

PCT/JP 98/00584

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

| Category | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
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| A | US 3 337 565 A (G.N. WALKER ET AL.) 22 August 1967 cited in the application see the whole document ----- | 1-26 |

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/JP 98/00584

| Patent document cited in search report | Publication date | Patent family member(s) | Publication date |
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